THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 19 APRIL, 1940 Number 4

GORDON C. KEITH

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FORTY-SECOND ANNUAL MEETING PROGRAM

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THE BULLETIN OF THE AMERICAN CERAMIC SOCIETY

Volume 19 April, 1940 Number 4

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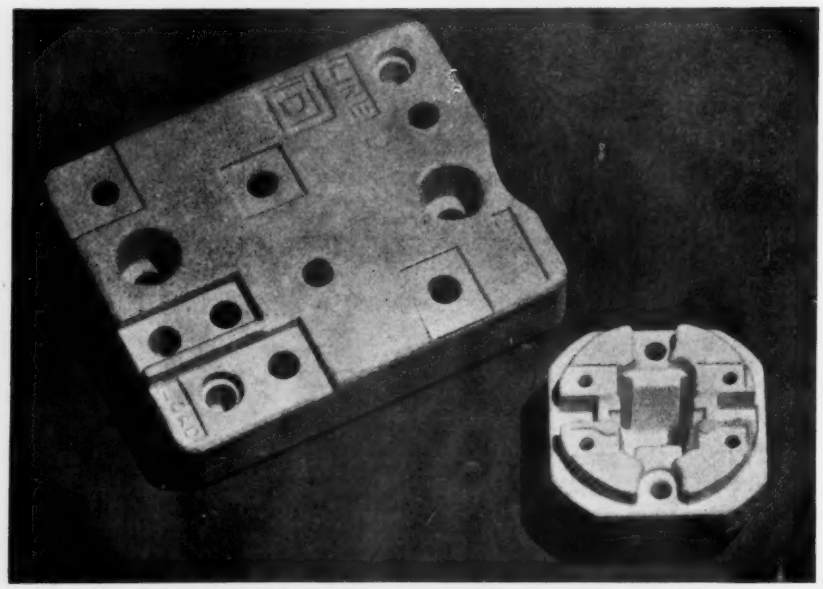

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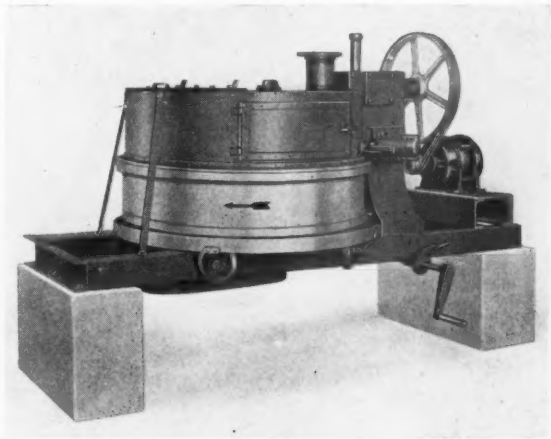

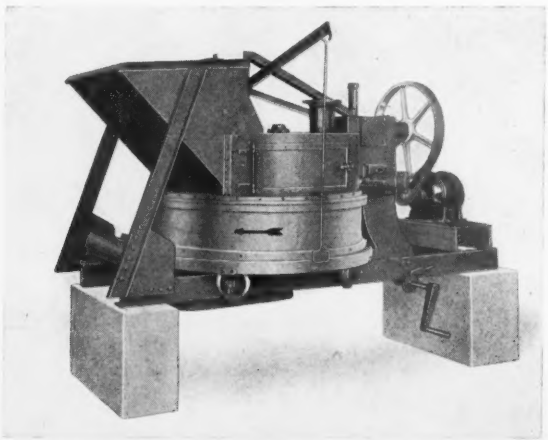

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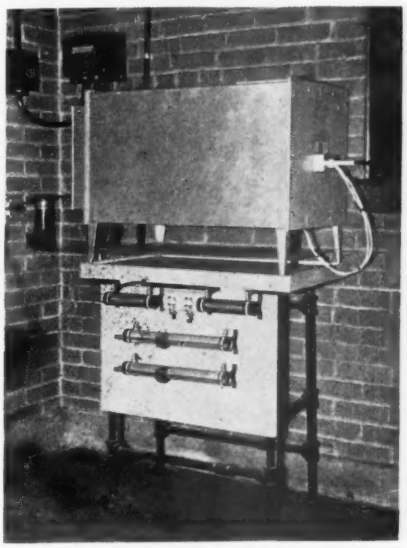

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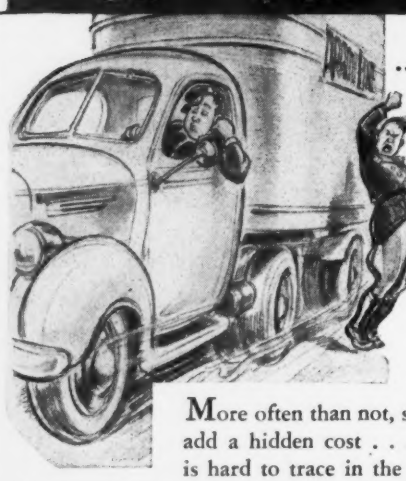

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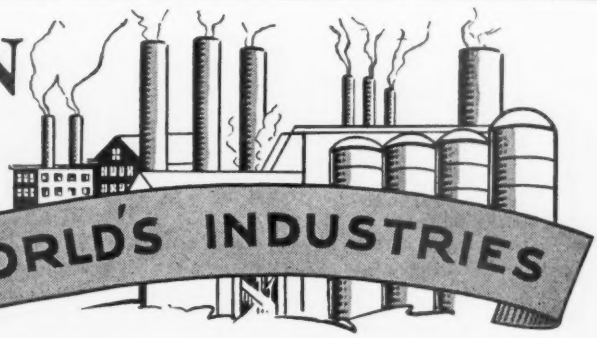

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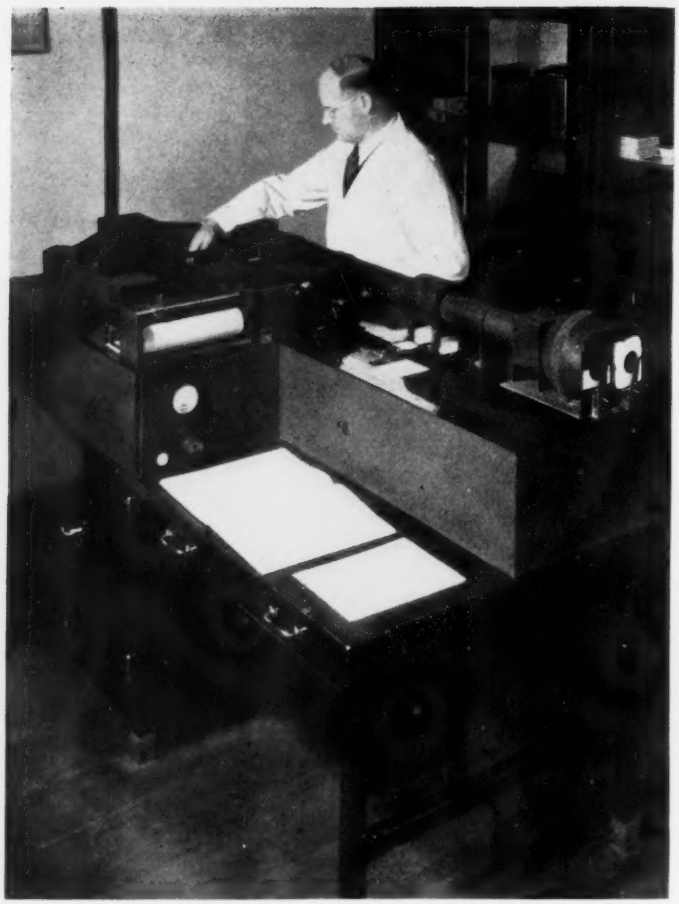

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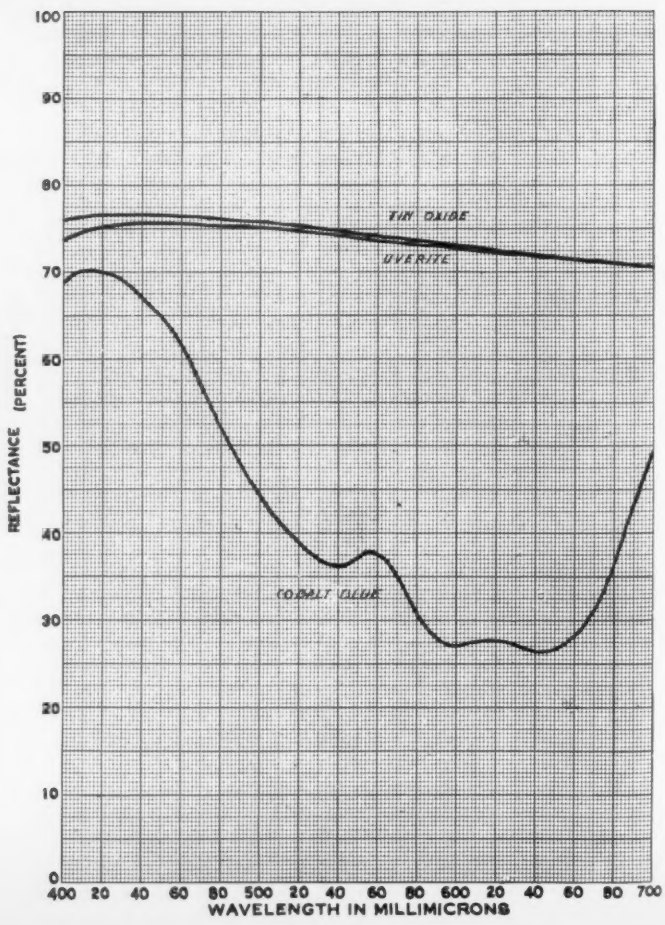

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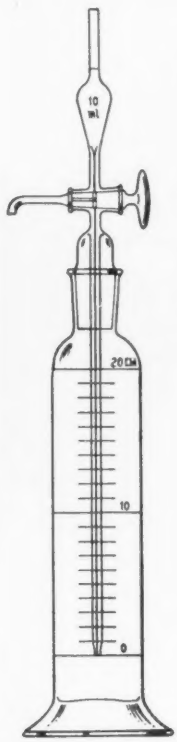

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Primary Protection Tubes for all makes of Pyrometers

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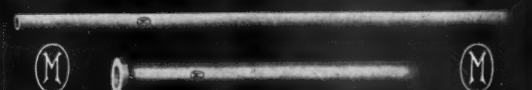

PYROMETER TUBES

★ CORUNDUM
★ MULLITE
★ REFRACTORY PORCELAIN

MONTGOMERY PORCELAIN PRODUCTS CO.
FRANKLIN OHIO

Abrasives
Carborundum Co. (*Carborundum and Aloxite*)
Celo Mines, Inc. (*Almanite Garnet*)
The Hommel Co., O., Inc.
Norton Co. (*Alundum-Crystolon*)

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Edgar Plastic Kaolin Co.
Foote Mineral Co.
The Hommel Co., O., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
Ceramic Color & Chemical Mfg. Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
Industrial Ceramic Products, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Barium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. (" *Carbofrax Aloxite*")
Denver Fire Clay Co.
Norton Co. (*Alundum-Crystolon*)

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Louthan Mfg. Co.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Bone Ash
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Borax
American Potash & Chemical Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Borax Glass
American Potash and Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Industrial Ceramic Products, Inc.
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. ("*Carbofrax Aloxite*")
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
The Vitro Mfg. Co.

Buckets (Concrete, Elevator)
Ransome Concrete Machinery Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Castings
Industrial Ceramic Products, Inc.
Lancaster Iron Works, Inc.

Castings (Abrasive Resisting)
Bethlehem Steel Co.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Solvay Sales Corp.

Caustic Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Pennsylvania Salt Mfg. Co.
Sauereisen Cements Co.

Ceramic Chemicals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Ceramic Specialties
American Lava Corp.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay (Bentonite)
American Colloid Co.
Edgar Plastic Kaolin Co.
Great Lakes Foundry Sand Co.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Clay (China)
Ceramic Color & Chemical Mfg. Co.
Georgia Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical, Porcelain)
Ceramic Color & Chemical Mfg. Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Enamel)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay (Fire)
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
United Clay Mines Co.

Clay (German Vallendar)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.

Automatic Car Elevators Reduce Ware-Setting Labor and Costs!

Here's another example of how ceramic plants get better results by letting Denison fill their special equipment needs! Denison designs and builds all types of movement-control and other machinery — hydraulic and mechanical. For equipment that pays dividends in accuracy, dependability and long-range economy, call on Denison.

New efficiency, ease and economy has been brought to one of the ceramic industry's most labor-wasting operations — the setting and unloading of ware. Hydraulic hoists, developed by Denison, keep working decks automatically at shoulder height, for greatest convenience. Kiln cars are lowered at constant speed during both the placing and removal of ware. As a result, placers work more rapidly with less fatigue. Supplying ware to placers on easily moved stilliards eliminates separate trips to the green room for each board of ware . . . and hand-transferring of loaded cars is reduced to the minimum. These advantages save time, decrease labor, reduce breakage — and save money!

In the picture above, the empty car at the extreme right has been elevated so that the lower deck is at shoulder height, ready for the placing of ware. At the far left is a fully loaded kiln car with the top deck lowered to convenient working height.

Remember, Denison has had years of specialized experience in building all types of production-movement equipment. You can depend on Denison for highest quality equipment; for the right answer to any machinery problem. Submit your requirements for recommendations.

It will pay you to learn more about this new Denison hydraulic elevator equipment. Why not write for complete details today? You will not be obligated in any way.

The Denison Engineering Co.

111 W. Chestnut St. Columbus, Ohio

Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

Clay Miners
American Colloid Co.
Edgar Plastic Kaolin Co.
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Potters)
Denver Fire Clay Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Process Equipment)
Hardinge Company, Inc.
Industrial Ceramic Products, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
Edgar Plastic Kaolin Co.
Georgia Kaolin Co.
Great Lakes Foundry Sand Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.
United Clay Mines Corp.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Wall Tile)
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel Co., O., Inc.

Cobalt Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Colors
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cones
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.

Crucibles (Filter, Melting, Ignition)
American Lava Corporation
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Industrial Ceramic Products, Inc.
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.
Ransome Concrete Machinery Co.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Disintegrators
Hardinge Company, Inc.
Industrial Ceramic Products, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electric Porcelain Presses
Kux-Lohner Machine Company

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.
Bethlehem Steel Co.

Enameling Muffles
Bethlehem Steel Co.
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
The DeVilbiss Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Exhaust Systems
The DeVilbiss Co.

Feldspar
Abingdon Sanitary Mfg. Company
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Taylor, Charles, Sons Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Green, A. P., Fire Brick Co.
Spinks, H. C., Clay Co.

Flint
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc R. & H. Chemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel Co., O., Inc.

French Flint
Maxson, Elwyn L.
Paper Makers Importing Co.

Frit
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradiant*)
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

PIONEER CLAY

Used by the trade since 1901

China Clay of high strength and low shrinkage used in

SEMI-PORCELAIN DINNERWARE
ELECTRICAL PORCELAIN
WALL AND FLOOR TILE

and for other ceramic purposes

UNIFORM AND DEPENDABLE HIGH QUALITY

Available for prompt shipment

WATER WASHED CRUDE AIRFLOATED

GEORGIA KAOLIN COMPANY

Mines and Plants at Dry Branch, Georgia

MAIN OFFICE
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NEW YORK OFFICE
230 Park Avenue
New York City

A REPORT ON THREE INTERESTING TANKS

IN August of 1938 we suggested, on this page, that any reasonable comparison of life and output of different glass furnaces requires *a Common Denominator*. This Common Denominator was suggested to be *the output* (in tons of glass) *per each square foot of melting area, per life.*

At that time we showed that the average output for five typical Corhart furnaces was 87.8 tons of glass per square foot per life.

We believe that the glass industry will agree that an average performance of 87.8 is indeed very good. But as our customers' experience with Corhart Electrocast increases, even this high average of eighteen months ago is being steadily raised. For instance, we have just received some rather impressive data from three furnaces which are still operating in the plants of two different companies. Repairs are not expected before the summer of 1940, in any case. One of these furnaces has already produced 127.4 tons per square foot of melting area, while the corresponding figures for tanks number two and three are 95 and 117, respectively. The tabulation below shows this data.

Furnace	Average Square Foot Rating	Total Production in Tons Per Square Foot of Melting Area	Life To Date In Days
Number 1	5.26	127.4	710
Number 2	6.76	95.0	673
Number 3	6.51	117.0	816

We suggest that you might find great interest and profit, by making your own comparisons, of your own tanks, with the figures above.

Corhart Refractories Co., Incorporated, 16th and Lee Streets, Louisville, Kentucky. . . *In Europe:* L'Electro Refractaire, Paris. *In Japan:* Asahi Glass Co., Tokio.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

SCHEDULE OF MEETINGS IN ROYAL YORK HOTEL, APRIL 7–13, 1940

Saturday, April 6

2:00 P.M.
Board of Trustees: Private Dining Room No. 9

8:00 P.M.
Board of Trustees: Private Dining Room No. 9

All Week

Camera Club, John M. McKinley, Chairman; J. Earl Frazier, Secretary-Treasurer: Private Dining Rooms Nos. 6–8
Exhibits of Ceramic Equipment and Materials: First Bedroom Floor
Bausch & Lomb: Room 140, First Floor
Editorial Headquarters: Room 141, First Floor
Meeting Service Headquarters: Room 139, First Floor

Sunday, April 7

10:00 A.M.
Ceramic Educational Council, John W. Whittemore, *President:* Dining Room No. 9

2:00 P.M.–5:00 P.M.
Fellows Meeting, Samuel R. Scholes, Dean: Ball Room

4:00 P.M.–6:00 P.M.
Afternoon Tea, Local Committee: Parlor B

8:00 P.M.
Edward Orton, Jr., Lecture by Wolsey G. Worcester, Department of Ceramic Engineering, University of Saskatchewan, Saskatoon, Sask., Canada: Concert Hall
Organ Recital and Ladies Chorus
Induction of Fellows and Installation of Officers of The Society

Monday, April 8

7:00 A.M.–9:00 A.M.
Breakfast Meeting, Publications Committee, Editorial Committees and Abstracters to attend, John D. Sullivan, Chairman*

9:30 A.M.–12:00 M.
General Session, Ceramic Ware Firing: A. I. Andrews, Chairman: Banquet Hall

12:30 P.M.
Joint Luncheon, Local Committee: Concert Hall
$1.00 per plate

2:00 P.M.–5:00 P.M.
General Session, Ceramic Ware Firing: A. I. Andrews, Chairman: Banquet Hall

2:00 P.M.–5:00 P.M.
General Session on Toxicology, Auspices of Materials and Equipment Division: O. I. Chormann, Chairman: Ball Room

4:30 P.M.
Institute of Ceramic Engineers, J. L. Carruthers, *President:* Hall A

6:00 P.M.–7:00 P.M.
Student Reception, Major E. Holmes, Chairman: Banquet Hall

7:00 P.M.–12:30 A.M.
Dinner and Dance—Entertainment, Local Committee: Concert Hall, $2.00 per plate

Tuesday, April 9

9:00 A.M.–12:00 M. and 2:00 P.M.–5:00 P.M. } Division Meetings
Art: Hall A
Enamel: Banquet Hall
Glass: Ball Room
Materials and Equipment: Hall B
Refractories: Concert Hall
Structural Clay Products: Private Dining Room No. 9
White Wares: Private Dining Rooms Nos. 1–5
Camera Club: All week: Private Dining Rooms Nos. 6–8
Exhibits, All week: First Bedroom Floor

5:00 P.M.–7:00 P.M.
Keramos Biennial Conclave, D. G. Bennett, *President:* Prince George Hotel

7:30 P.M.–9:00 P.M.
Institute of Ceramic Engineers, J. L. Carruthers, *President:* Hall A

9:00 P.M.
A Night at Pig and Whistle Tavern, Stroller Show, Refreshments: Concert Hall (admission $0.50), Local Committee

Wednesday, April 10

7:00 A.M.
Breakfast Meeting, Board of Trustees: Lounge

9:00 A.M.–12:00 M. and 2:00 P.M.–5:00 P.M. } Division Meetings as on Tuesday

12:30 P.M.–2:00 P.M.
Division Luncheons, Enamel, Glass, and Refractories: In their respective meeting rooms, $1.00 per plate

6:00 P.M.–8:30 P.M.
School Alumni Meetings: At places of their appointments*

Thursday, April 11

9:00 A.M.–12:00 M.
Division Meetings, Enamel and White Wares and Materials and Equipment: In their respective meeting rooms

* Room to be announced.

WOMEN'S PROGRAM SCHEDULE

Sunday, April 7

4:00–6:00 P.M.
Tea at Royal York Hotel: All registrants invited (no charge)

Monday, April 8

7:00 P.M.–12:30 A.M.
Dinner and Dance—Entertainment: Local Committee: Concert Hall

Tuesday, April 9

9:00 P.M.–12:30 A.M.
A Night at Pig and Whistle Tavern, Stroller's Show and Lucky Draws, Concert Hall (admission $0.50)

2:00 P.M.
Trip through Eaton's Department Store with a Five o'Clock Tea (no charge)

Wednesday, April 10

10:00 A.M.
Trip around the City of Toronto and lunch at the Old Mill. A souvenir of this Canadian visit will be presented to each guest.
Following lunch, trip to Royal Ontario Museum (no charge).
A Women's Parlor will be maintained throughout the Meeting week where visiting women may rest or obtain information. Members of the Canadian Women's Committee will be present as hostesses.

HOW TO HANDLE CURRENCY EXCHANGE

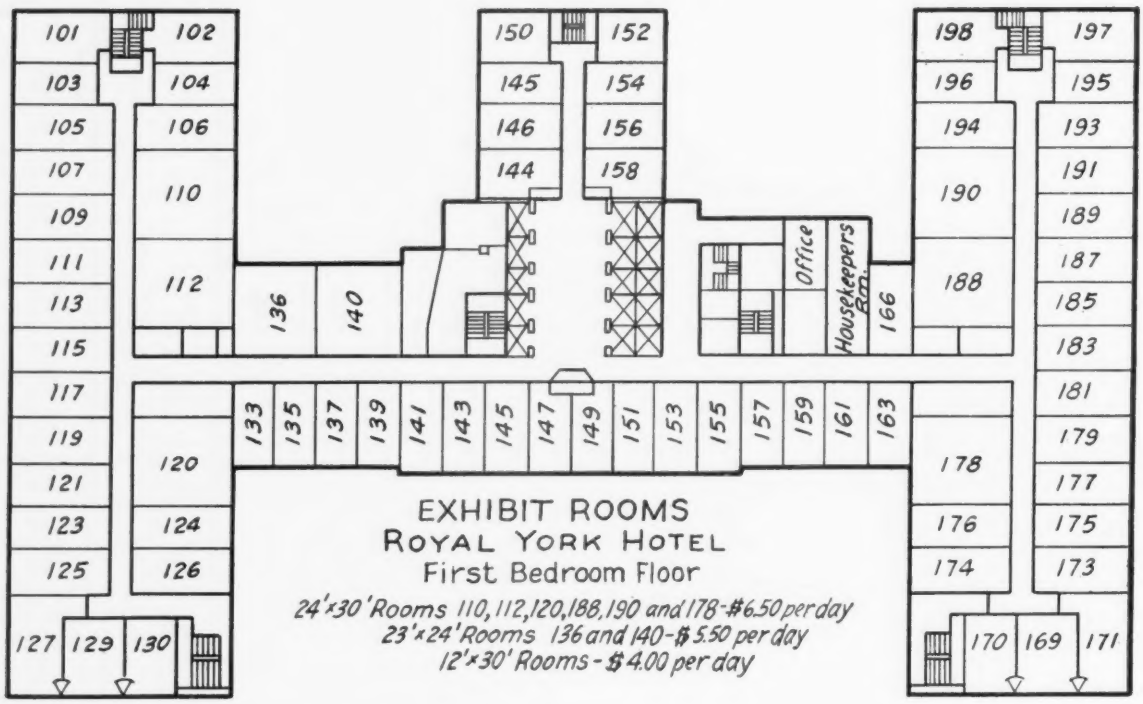
I think you would be wise to advise the members of The American Ceramic Society not to purchase Canadian funds in the United States. They are likely to be charged a heavy service percentage which will prevent them from securing the full benefit of the 10% premium on American funds that now exists in Canada. They may bring in currency, traveler's checks, or they may draw checks upon their own bank accounts and secure this 10% premium at any bank, in any first-class hotel, or at any first-class place of business in the City of Toronto.

(Signed) T. H. R. McNally, *Manager, Toronto Convention and Tourist Association, Inc*

The exchange control board on January 27 announced a new regulation authorizing merchants, hotel keepers, and other residents serving tourists to accept foreign currency from visitors at the official rates.

It would be advisable for your members to make their exchange in currency here and they will receive 10% on their money. There are banking facilities in the Hotel, and there will be no difficulty whatsoever in this regard. If your registration fees and dues are payable in United States funds, your Society will not suffer any loss.

(Signed) J. JOHNSON, *Manager, Royal York Hotel*



BALOPTICON PROJECTION LANTERN EQUIPMENT

The lanterns and projectors used in the technical sessions at this Meeting have been rented from the Bausch & Lomb Optical Company, Rochester, N. Y.

BAUSCH & LOMB EXHIBIT

The Bausch & Lomb Optical Company exhibit will be located in Exhibit Room No. 140, First Bedroom Floor. Members of The Society are urged to visit this educational exhibit.

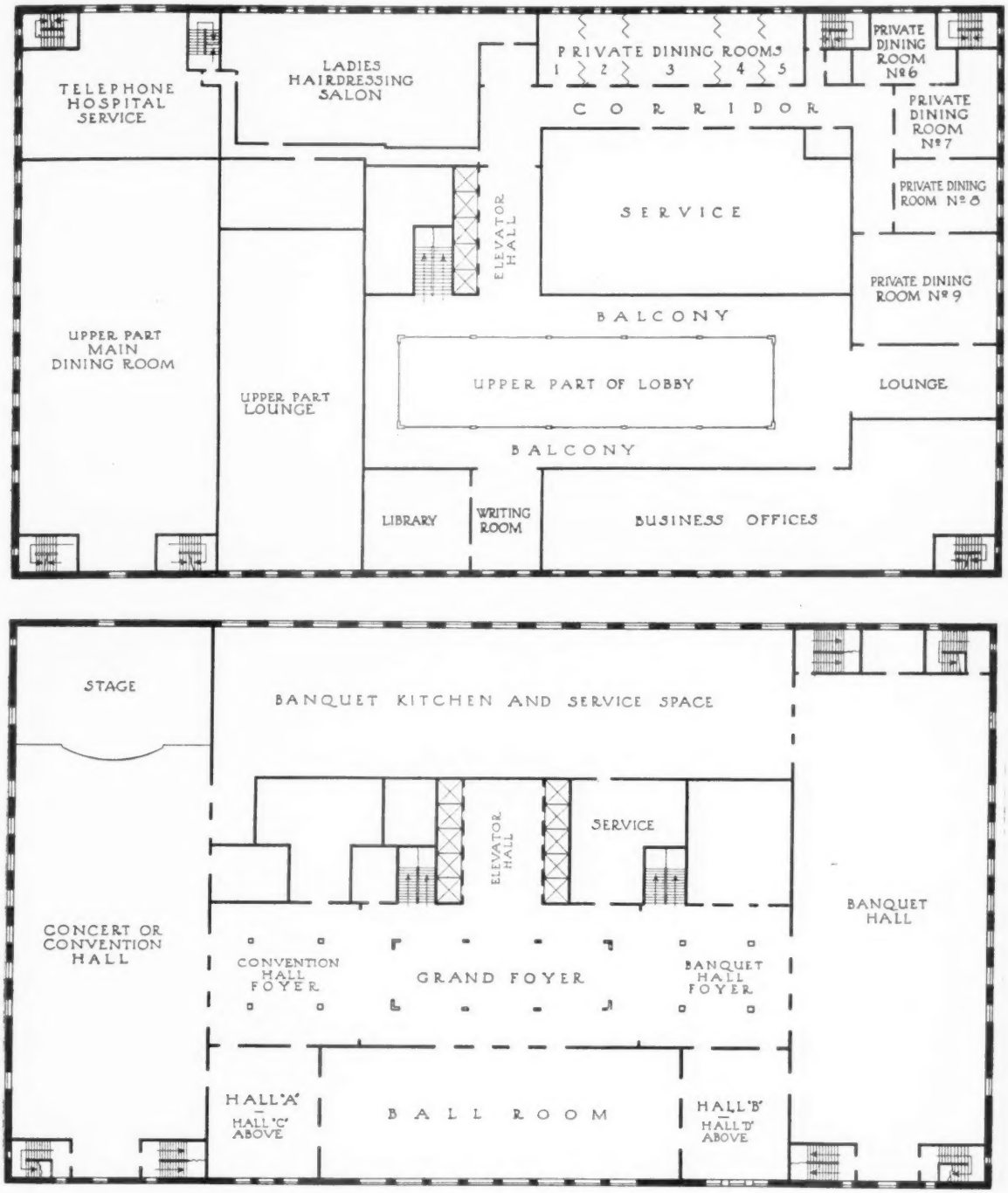
Representatives of the Company will be in attendance daily during the Meeting.

Personal Members can increase their cooperative production if more ceramic corporations will give financial support.

Forty-Second Annual Meeting

AMERICAN CERAMIC SOCIETY

Toronto, Canada, April 7–13, 1940, Royal York Hotel



Floor plans of Royal York Hotel, Toronto, Canada

(1940)

INFORMATION FOR U. S. EXHIBITORS AT TORONTO MEETING

(1) Exhibitors should address their shipments as follows:

American Ceramic Society Annual Meeting
For .....(name of exhibitor)
c/o Bertram & Cumming, Customs Brokers,
159 Bay St.,
Toronto, Canada

(2) Invoices (in triplicate) and bills of lading must be mailed immediately on shipment to Bertram & Cumming. Invoices must be made in triplicate, showing the Fair Market value, and be certified with the signature of the shipper. *Do not attach invoices to shipment.*

(3) Shipments should be timed to arrive several days before the Meeting date, to allow reasonable time for customs entry and delivery.

(4) Invoices should show the number and kind of packages, and each article should be itemized and the true value shown.

(5) There is no duty on exhibits being shipped into Canada from the United States for exhibition purposes, or returning to the United States. There *is* duty on advertising matter, samples, souvenirs, etc., but if arrangements are made with the Toronto Convention & Tourist Association they will assume any duty imposed.

(6) Advertising matter and material which is to be distributed free must be shipped separately and invoiced separately from goods which are for exhibition purposes only. All printed matter must be marked "Printed in U. S. A.," and invoices for such material must show net weight as well as the value.

(7) Brokers' fees, cartage, express, freight, and demurrage charges must be paid by the shipper. *All shipments must be prepaid.*

(8) Shipments must be returned to the United States in the original number of packages shipped to Canada. Should any equipment be sold while on exhibition, to remain in Canada, the purchaser must pay the duty.

(9) Exhibitors should furnish the official customs brokers, Bertram & Cumming, with an affidavit on U. S. Customs Form No. 3311, in order that free entry into the United States may be facilitated.

(10) Exhibitors should ship by rail freight or express, prepaid. If, however, exhibits are to be taken by private automobile, the Canadian Customs Form A-8 must be signed at the Port of Entry. This will permit proceeding to Toronto, where the exhibitor must report to the Canadian Customs officer.

TORONTO LOCAL COMMITTEES

Honorary Chairmen

A. U. Coté, General Manager, The Cooksville Co., Ltd., 46 Bloor St., West, Toronto.

General C. H. Mitchell, Dean, Faculty of Applied Science and Engineering, University of Toronto, Toronto.

Wilfrid Mavor, Vice-President, Ferro Enamel Corp., 629 Wellington St., Ottawa, Ont.

Executive Committee

Chairman: W. C. McGolpin, General Manager, National Fire Proofing Co., Ltd., 96 Bloor St., West, Toronto.

Secretary: Gordon C. Keith, 49 Turner Road, Toronto 10.

President, Canadian Ceramic Society: H. A. Bevens, Manager, Insulation Products, Ltd., 33 Strathmore Blvd., Toronto 5.

Women's Committee

Mrs. A. E. R. Westman, 35 Glenayr Rd., Toronto.

Mrs. R. J. Montgomery, 7 Cottingham Rd., Toronto.

General Committee

H. F. Dingledine, Production Manager, National Sewer Pipe Co., Ltd., Wentworth St., N., Hamilton, Ont.

W. Fraser Findlay, Superintendent, Findlay's, Ltd., Carleton Place, Ont.

George Hunt, Superintendent, Enamel Division, General Steel Wares, Ltd., River St., Toronto.

G. C. Irvine, Canadian Carborundum Co., Ltd., Niagara Falls, Ont.

W. A. Irvine, Canadian General Electric Co., Ltd., Ward Street Works, 224 Wallace Ave., Toronto.

R. J. Montgomery, Professor of Ceramic Engineering, University of Toronto, Toronto 5.

W. E. Patterson, Chief Chemist, G. F. Sterne & Sons, Ltd., Brantford, Ont.

W. P. Pulkingham, President, Canadian Potters, Ltd., Sherman Ave., N., Hamilton, Ont.

B. Stone, General Manager, Smith & Stone, Ltd., Georgetown, Ont.

Theodore Tafel, Jr., Manager, Standard Sanitary Mfg. Co., Ltd., 1000 Lansdowne Ave., Toronto.

EIGHTH NATIONAL CERAMIC EXHIBITION

The Exhibition of Contemporary American Ceramics selected from the Eighth National Ceramic Exhibition, held at the Syracuse Museum of Fine Arts, will be shown in Toronto, Canada, during the Forty-Second Annual Meeting of The Society, April 7–13, 1940. This Exhibit will be shipped to Toronto from the St. Louis Art Museum, St. Louis, Mo.

Following the Syracuse showing, the Exhibition was booked by the Cleveland Museum of Art (for the second time) and went from there to the Memorial Art Gallery in Rochester (booked for the third time). In January, the Oberlin College Gallery had the exhibit, and from there in February it went to the University of Pittsburgh (also for a third booking).

The critics have been enthusiastic in each place, and it is agreed that the Exhibition grows in quality as well as in scope.

An article in the November, 1939, *Magazine of Art* by Russell Barnett Aitken, member of the Jury of the Eighth National Ceramic Exhibition, states the following: "The Eighth Annual National Ceramic Exhibition gives ample proof that with a modicum of encouragement a craft can blossom into maturity and importance. Sculptors and potters are now creating pieces especially for the National Show instead of sending on something which happened to be available at the moment, and the number of entrants has trebled since the earlier exhibitions. The pieces selected by the Jury for circuit to an imposing list of museums are characterized by great dignity and originality of expression. They make up a strong circuit show. The pottery is particularly fine in this Exhibition, showing infinite taste in line and texture of glaze.

"The standard of the show in general is remarkably high, and one cannot fail to be impressed by the great strides the ceramists of America have made in a short decade."

In 1932, the Syracuse Museum espoused the cause of the ceramists, and in the following years, ceramic art in America has achieved the stature of an important medium. The succeeding Syracuse Ceramic Exhibitions have grown in scope and size, and the Museum's circulating exhibits are creating a demand for an even more ambitious program.

MEETING SERVICE COMMITTEE

Robert M. Campbell, Professor of Ceramic Technology, New York State College of Ceramics, Alfred, N. Y., will serve as Chairman of the Meeting Service Committee in Toronto. Frank C. Arrance, senior in the Department of Ceramic Engineering, will be Assistant Chairman, and seniors of this Department and senior girls of the Art Department will serve on this Committee.

HOTEL RATES

Rates for the General Membership of the Meeting will be $4.00, $4.50 and $5.00 per day for single rooms, and $7.00, $7.50 and $8.00 per day for double rooms, depending on the size and location of the rooms. Each person will have a separate bed, and all rooms are equipped in the modern manner with tub and shower bath, as well as radio loudspeaker.

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WRITE TO

CELO MINES, INC.

BURNSVILLE, NORTH CAROLINA

GENERAL SESSION ON FIRING, COMBUSTION, AND UNIFORM HEAT DISTRIBUTION IN CERAMIC KILNS AND FURNACES

Royal York Hotel: Banquet Hall

Monday Forenoon and Afternoon, April 8, 1940

Chairman: A. I. Andrews, President, The American Ceramic Society

9:30 A.M.–12 M.

1. Presidential Address

By Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

2. Physical Chemistry of Gas Producer Reactions in Relation to Ceramic Firing

By A. W. Gauger: Department of Mineral Industries, Pennsylvania State College, State College, Pa.

Air-blown producer gas reactions occur in the firing of any thick, solid fuel beds. These consist of the following fundamental reactions:

$$\underbrace{C + O_2 + 3.76\ N_2}_{\text{air}} = CO_2 + 3.76\ N_2$$

$$CO_2 + 3.76\ N_2 + C = \underbrace{2\ CO + 3.76\ N_2}_{\text{producer gas}}$$

Ordinarily the producer gas thus formed is burned at the top of the fuel bed upon admission of secondary air. This, however, need not necessarily be the case. In fact, the earliest developments in producer gas art were along the lines of leading the gas away from the top of the fuel bed and combusting it at some more convenient place. This seems to offer some opportunity for reexamination of the technique of ceramic firing with solid fuel.

The gas producer, furthermore, offers a convenient means of making gas for firing in those processes that are best served by a gaseous fuel. In this country, producer gas usually refers to gas made by blowing air and steam through the hot fuel bed.

Both of the reactions involved in making "air-blown" and ordinary producer gas are important in any theoretical study of the producer-gas process as affecting the ceramic industry. The paper presents a theoretical study of these reactions, involving both the physical chemistry and thermodynamics thereof.

3. Importance and Economics of Combustion Control

By R. C. Hutchison: Bethlehem Steel Company, Incorporated, Bethlehem, Pa.

This paper discusses briefly the basic principles of combustion and the effects and results of a lack of or an excess amount of air in the combustion of a fuel. Data are given on necessary equipment and personnel to follow up and properly control combustion. The economic advantage and probable saving to be expected with this type of control are also discussed.

4. Control for Luminous-Flame Firing in Glass Furnaces

By G. W. Batchell and F. G. Schwalbe: Toledo Engineering Company, Incorporated, 958 Wall St., Toledo, Ohio

Luminous-flame firing of natural gas in glass furnaces has been accomplished inefficiently and with difficulty for many years in an attempt to secure the advantages of the luminosity characteristics. Luminosity in the gas flame is now secured by retardation of combustion between overlying layers of air and gas, the resulting flame being particularly adapted for glassmelting. A successful method for controlling the length and shape of the luminous flame in a glass furnace involves the mixing of spent gases from the flue with the incoming fuel gas.

2:00–500 P.M.

5. Some Methods of Firing Fuels in Tunnel Kilns

By George D. Brush: Harrop Ceramic Service Company, Columbus, Ohio

Tunnel kilns are now widely used in the ceramic industry, and coal, fuel oil, and gas are being used successfully as fuels. The various methods of firing these fuels, together with their relative merit, will be discussed. Only methods used in commercial tunnel-kiln practice will be considered.

6. Electric Firing of Ceramic Products

By Hewitt Wilson and McDonald S. Nelson: Electrotechnical Laboratory, Bureau of Mines, Norris, Tenn.

The results of electrically firing 7-inch hotel plates, full-sized toilet bowls, and face brick are compared with those fired in commercial combustion kilns. Tests of the uniformity of heat distribution and the costs of electric firing are discussed.

7. Testing of Porcelain Enameling Furnaces

By M. Bozsin (presented by G. H. McIntyre): Ferro Enamel Corporation, Cleveland, Ohio

The apparatus and technique for testing various types of porcelain enamel furnaces, including the analysis of the muffle atmosphere, burner efficiency, control pyrometer, uniformity of temperature in the furnace, and the interpretation of results, are described in detail. This work is a continuation of that begun by G. H. McIntyre and others several years ago. Data are presented from many production enameling furnaces under various commercial conditions.

From an analysis of the atmospheric conditions of forty-two enameling furnaces, the results on the fired ware are influenced according to the summary table.

Conditions of fired ware	Water by volume (%)	Carbon dioxide by volume (%)	Nitrogen by volume (%)	Oxygen by volume (%)
Good	1.32	0.10	78.44	20.14
Fair	2.22	0.32	77.48	19.98
Poor	3.10	1.65	76.43	18.82

Numerous examples of varying types of time-temperature cycles in continuous furnaces are given, and suggestions are made for improved firing conditions.

8. Pyrometric Rings for Measuring Kiln Heat Treatment

By L. H. Milligan: Norton Company, Research Laboratories, Worcester, Mass.

Pyrometric cones, which are the usual standard method for measuring ceramic kiln heat treatment, are satisfactory for the purpose when their deformation characteristics are proportional to the maturing characteristics of the ware being fired. In the case, however, of certain abrasive products consisting of refractory granules bonded with ceramic mixtures which are matured to a bond relatively high in glass phase, the maturing characteristics of cones are not always a satisfactory measure of the properties of the product, and "pyrometric rings" have been developed for use in place of cones.

Pyrometric rings, approximately $1^1/_2$ inches in outside diameter, $^3/_4$ inch high, and with a $^7/_8$-inch diameter hole, are molded from the same kind of raw ceramic powder mixture that is used for cone manufacture, except that a powder of a composition ordinarily used for cones 9 or 10 is employed for molding the pyrometric rings to be used for measuring heat treatments in the vicinity of cone 12. In other words, the deformation characteristics of No. 9 or No. 10 cone powder are employed for quantitative measurements of heat treatments in the vicinity of cone 12. The ring is set on a refractory plate and is given the kiln heat treatment along with the ware. Plug gauges are used to measure the hole remaining in the ring after the fire, and these are calibrated in terms of the strength of bonding of the product being fired.

9. Discussion of the Relation of Dimensional Accuracy of Cones and Their Composition

By A. W. Helz: Edward Orton, Jr., Ceramic Foundation, Columbus, Ohio

In this study, cone shrinkage was eliminated by the addition of calcined clay and by holding the plastic content of the cones constant.

General Discussion

EDWARD ORTON, JR., FELLOW MEMORIAL LECTURE

"ORTON, THE CERAMIST"

by

WOLSEY G. WORCESTER, DEPARTMENT OF CERAMIC ENGINEERING,
UNIVERSITY OF SASKATCHEWAN,
SASKATCHEWAN, SASKATOON,
CANADA

SUNDAY EVENING, APRIL 7, 1940, 8:00 P.M.

ROYAL YORK HOTEL: CONCERT HALL

GENERAL SESSION ON TOXICOLOGY

Auspices of the Materials and Equipment Division

Royal York Hotel: Ball Room

Monday Afternoon, April 8, 1940: 2:00 P.M.–5:00 P.M.

Chairman: O. I. Chormann, The Pfaudler Company, Rochester, N. Y.

2:00–2:30 P.M.

1. Recent Legislation on Occupational Diseases

By T. C. Waters: Mullikan, Stockbridge, and Waters, Baltimore, Md.

2:30–3:00 P.M.

2. Pathological Influence of Dusts in the Ceramic Industry

By Dudley Irwin: Banting Institute, University of Toronto, Toronto, Ontario, Canada

The speaker will explain the function of the lung and how the presence of dust interferes with its normal function. Toxicity of various kinds of dusts, the ways of determining the amount and toxicity of dusts encountered in industry, and methods that may be applied to prevent the development of silicosis are discussed. This talk will be illustrated by lantern slides.

3:00–3:30 P.M.

3. Undesirable Guests in the Human Lungs

By E. Poitevin: Canadian Department of Mines and Resources, Ottawa, Ontario, Canada

A large number of human lungs derived from normal individuals from persons engaged in various industries was studied. A great variety of inorganic substances was found to constitute the insoluble residues of lung ash minerals. Abrasives, glass, enamels, coal ash, etc., were identified and described, and the methods used to obtain these results are outlined. Cases of industrial silicosis are compared with those of mining origin. Suggestions are made for the elimination of dust hazards in our industries, cities, and homes.

3:30–4:00 P.M.

4. Relative Toxicity of Lead and Some of Its Common Compounds

By Lawrence T. Fairhall: Division of Industrial Hygiene, National Institute of Health, Washington, D.C.

An investigation was made of the relative toxicity of lead and various lead compounds, commonly encountered (including lead arsenate, lead carbonate, lead chromate, litharge, red lead, lead peroxide, lead phosphate, lead silicate, lead sulfate, and lead sulfide) following the administration of these substances by mouth, by intraperitoneal injection, and by inhalation.

Symptoms of lead poisoning such as muscular incoordination and anemia were sought; blood changes with respect to the red cells, particularly basophilic stippling, polychromasia, and morphologic changes were noted; and blood calcium determinations were made. Body weight changes and mortality figures were collected. The lead was administered in known amounts by ingestion, injection, and inhalation, and its distribution in such tissues as the liver, kidney, bones, lungs, and carcass was determined after such exposure.

The toxic effect of lead compounds was more evident on inhalation than when administered either by mouth or by intraperitoneal injection; this emphasizes the importance of this type of exposure in dusty trades employing lead.

The order of toxicity as shown by feeding experiments did not vary much for a number of the compounds studied. Lead carbonate, lead monoxide, and lead sulfate, however, were shown to be more toxic by mouth than metallic lead or the remaining lead compounds. Lead carbonate and lead monoxide were more toxic following inhalation than the other compounds studied.

4:00–4:30 P. M.

5. Health of Brick and Tile Plant Workers in North Carolina

By M. F. Trice: Division of Industrial Hygiene, North Carolina State Board of Health, Raleigh, N. C.

This paper reviews some of the data obtained in an investigation of the North Carolina brick and tile industry to evaluate the siliceous dust exposure of the workers in terms of hazards to health, particularly with respect to silicosis. The distribution of the forty-eight plants is shown by map and classified as to raw material employed, i.e., alluvial clay or shale. Plant equipment and operating practices are reviewed in a general discussion of the industry. The extent of the dust exposure of the workers by occupational classification is appraised in terms of millions of particles of dust per cubic foot of air, which is based on particle-count analyses of 183 samples of airborne dust collected in twenty-eight plants. An evaluation of the health status of the workers is based on medical data obtained in the clinical and X-ray examination of 1550 employees in an equal number of plants, most of which were the same as those in which dust samples were obtained. There is presented an analysis of the more important medical data. The investigation disclosed that none of the employees had silicosis, a fact which apparently is explained by a low quartz content of the atmospheric dust, an absence of excessive concentrations of dust, and a high labor turnover.

4:30–5:00 P.M.

6. Engineering Control of Dust with Special Reference to Respirators

By A. D. Brandt: Willson Products, Incorporated, Reading, Pa.

A brief discussion will be presented of the more common methods of reducing or controlling the respiratory hazard due to dust. Specific methods named are (1) control of dust at point of dust generation; (2) isolation of dusty processes; (3) substitution of nonhazardous process; and (4) reduction of dust in inspired air by means of respiratory protective devices. The general methods are (1) general ventilation, (2) good housekeeping, and (3) a rigid inspection of all control devices. The remainder of the paper will be devoted to a detailed discussion of respirators, their proper use, construction, maintenance, and Bureau of Mines approval.

ART DIVISION PROGRAM

Chairman: J. P. Thorley, Parkway, East Liverpool, Ohio
Secretary: C. C. Engle, United Clay Mines Corporation, Trenton, N. J.

Program Committee
L. E. Barringer, Chairman, General Electric Company, Schenectady, N. Y.
W. A. Weldon, 621 Edgewood Street, Baltimore, Md.
E. de F. Curtis, Conestoga Pottery, Wayne, Pa.

Royal York Hotel: Hall A

Monday Afternoon, April 8, 1940

2:00 P.M.

Business Meeting and Announcements

ART DIVISION PROGRAM (continued)

Art Gallery of Toronto (Dundas Street)

Tuesday Forenoon, April 9, 1940: 10:00 A.M.–12:00 M.

10:00–11:00 A.M.

1. Canadian Art (illustrated)

By Fred S. Haines: Principal, Ontario College of Art

11:00–11:30 A.M.

2. English Pottery

By H. T. Thompson: Manager, Copeland-Duncan, Limited

11:30 A.M.–12:00 M.

3. Art Pottery as a Means of Rehabilitation

By Jack M. Smoot: National Youth Administration for Georgia, Atlanta, Ga.

The present foreign artware supply and its relation to the unemployed domestic worker is discussed. The background of a European craftsman is reviewed and compared with American training methods. A vocational approach to art craftsmanship, which features work experience in the manufacture of art pottery, is presented.

Art Division Luncheon

Eaton's College Street, Eighth Floor

12:30 P.M.–1:45 P.M.

Art Gallery of Toronto (Dundas Street)

Tuesday Afternoon, April 9, 1940

2:00 P.M.–4:15 P.M.

2:00–2:45 P.M.

4. Teaching Ceramics in Toronto Schools

By Peter Haworth: Central Technical School of Toronto

2:45–3:15 P.M.

5. The Curriculum in Industrial Ceramic Design at The New York State College of Ceramics

By Charles M. Harder: Department of Ceramic Art, New York State College of Ceramics, Alfred, N. Y.

3:15–3:45 P.M.

6. Kiln Installation in the Ceramic Department, University of Pittsburgh (illustrated)

By J. P. Thorley: University of Pittsburgh, Pittsburgh, Pa.

3:45–4:15 P.M.

7. The Ceramic Extension Program of The Pennsylvania State College

By Edward P. McNamara: School of Mineral Industries, Pennsylvania State College, State College, Pa.

There is a demand throughout the ceramic industries for courses of less than college grade for the training of men for positions requiring skill and responsibility. This demand is being met in Pennsylvania by the Ceramic Extension Course of the Division of Mineral Industries Extension. The course consists of a three-year curriculum offering third-year options in clay products and whiteware, refractories, glass, and enamels. A printed and bound textbook is prepared for each year of the course. Classes are held in the plant or in the same city as the plant, and the teachers are experienced ceramic engineers. Teaching funds are made available by the state and federal governments. The history, present status, and future plans of the course are presented.

Art Division Tea: Art Gallery of Toronto

Tuesday Afternoon, April 9, 1940: 4:30 P.M.

The Canadian Guild of Potters is host to the members of the Art Division attending the Forty-Second Annual Meeting of The American Ceramic Society

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Art Gallery of Toronto (Dundas Street)

Wednesday Forenoon, April 10, 1940

10:00 A.M.–12:00 M.

10:00 A.M.

8. Symposium on Pottery Glazes

Speakers to Be Announced.

10:30 A.M.

9. Modern Grecian Glassware (illustrated)

By Alexander Silverman: Department of Chemistry, University of Pittsburgh, Pittsburgh, Pa.

11:00 A.M.

10. Artist versus Designer for Glass

By Alexander Silverman

Inspection of Gallery Exhibits of Ceramics

At the Art Gallery of Toronto, there will be an exhibition of ceramic products, including an exhibit of local work by the Canadian Guild of Potters, English pottery, and the traveling Robineau Exhibition (the Eighth National Ceramic Exhibition) from Syracuse.

Art Division Luncheon

Eaton's College Street, Eighth Floor

Wednesday Afternoon, April 10, 1940: 12:30 P.M.–1:45 P.M.

ART DIVISION PROGRAM (concluded)

Royal Ontario Museum (100 Queen's Park)

Wednesday Afternoon, April 10, 1940: 2:00 P.M.–4:30 P.M.

2:00 P.M.

11. Stained Glass in the Washington Cathedral (shown by slides)

2:15 P.M.

12. The Development of English and Irish Glass (Gallery talk)

By F. St. George Spendlove: Royal Ontario Museum, Toronto, Ontario

2:30 P.M.

13. Chinese Ceramics (Gallery talk)

By Bishop William Charles White: Royal Ontario Museum, Toronto, Ontario

4:30 P.M.

Tea in Museum Tearoom

ENAMEL DIVISION PROGRAM

Chairman: W. H. Pfeiffer, Engineering Laboratory, Plant 2, Frigidaire Division, General Motors Corporation, Dayton, Ohio
Secretary: Dwight G. Bennett, Mellon Institute, Pittsburgh, Pa.
Program Committee
James D. Tetrick, Chairman, Baltimore Enamel & Novelty Company, Baltimore, Md.
Perry C. McCollom, Metal and Thermit Corporation, Carteret, N. J.
Roger L. Fellows, Chicago Vitreous Enamel Product Company, Cicero, Ill.

Royal York Hotel: Banquet Hall

Tuesday Forenoon, April 9, 1940: 9:30 A.M.–12:30 P.M.

9:30–10:00 A.M.

1. Enameling Iron, Its Properties and Characteristics and Their Relation to the Enameling Process

By Joseph C. Eckel and John A. Eckel: Carnegie-Illinois Steel Corporation, Gary, Ind.

The present-day continuous mill enameling sheet is described, together with its physical, chemical, and microscopic properties, and their relation to the enameling process. The heat treatment, mechanical working, and other phases of mill operations which tend to influence the performance of the sheet during enameling are discussed.

10:00–10:30 A.M.

2. Relation of Defects in Enamel Coatings to Hydrogen in Steel

By C. A. Zapffe and C. E. Sims: Battelle Memorial Institute, Columbus, Ohio

The theories of hydrogen in steel are briefly discussed and illustrated by experiments of a metallurgical nature. It is then shown experimentally that enameling stock contains harmful quantities of hydrogen and that this hydrogen appears during firing to cause blisters in the soft enamel and after firing to cause chipping of the hard enamel. The high-temperature effusion is one of the causes for the numerous phenomena, such as "boiling," "primary boiling," "reboiling," "blistering," "bubbling," etc., which formerly have not only been separately defined but have seldom been identified with hydrogen evolution, in spite of the fact that direct analysis of the evolved gas has shown that hydrogen often predominates. The low-temperature effusion is shown to be concerned in "fish-scaling," "delayed fishscaling," "pop-offs," "jumping," "shivering," "shiners," many cases of "chipping," and perhaps "bursting" of the enamel on cooking utensils. The present terminology for enameling defects is thus not only redundant, but the defects have been incompletely and, in part, incorrectly explained. An indirect effect of hydrogen on "copperheads" and "black specks" is also identified.

An exhaustive review of both English and German literature on enameling defects is included. Many observations recorded in the literature are shown to agree with the hydrogen theory.

The functions of hydrogen with time, temperature, and impurities in steel are described and demonstrated by experiment. Experimental evidence is also presented to show that the blistering and boiling action over carbide areas in steel is due principally to hydrogen that associates with the carbon and not to carbon oxide gases.

Certain types of inclusions in steel are shown to react with occluded hydrogen to form compounds that will not dissociate appreciably at some enamel-firing temperatures, and critical quantities of the hydrogen are therefore prevented from reaching the enamel coating during firing to cause blistering and related defects. In view of this type of reaction and the fact that carbon steel can be enameled quite successfully if free of hydrogen, it is suggested that the enameling industry might use cheaper steel for enameling stock.

10:30–11:00 A.M.

3. Some Factors Affecting Sagging Tests on Enameling Iron

By J. J. Canfield: The American Rolling Mill Company, Middletown, Ohio

Such factors as furnace temperature, heating time, width of sample, effect of enamel coating, distance between supports, and metal composition are discussed.

11:00–11:30 A.M.

4. Phosphorus Steels for Vitreous Enameling

By C. H. Lorig and D. E. Krause: Battelle Memorial Institute, Columbus, Ohio

A summary is given of the tests which were conducted to appraise the utility of phosphorus steels in vitreous enameling. Enameling tests were made on killed and rimmed steels of low-carbon iron and steel with a phosphorus content up to 0.60%. Phosphorus was found to reduce the sag of laboratory-prepared enameling stock to a marked degree. The most effective range of phosphorus was from 0.10 to 0.15%, and killed steels were superior to rimmed steels in their sag resistance. Phosphorus appeared to have no significant influence on common enameling defects. In amounts of less than 0.40%, it had no marked effect on the adherence of the enamel. The deep drawing qualities of the sheet, based on Olsen ductility tests, were somewhat impaired by phosphorus. This is in line with the strong tendency for phosphorus to raise the strength of the sheet. (Published *Jour. Amer. Ceram. Soc.*, **23** [4] 107–10 (1940).)

11:30 A.M.–12:00 M.

5. Enameling Iron Oxidation Phenomena

By L. C. Athy and P. C. Stufft: Porcelain Enamel and Manufacturing Company, Baltimore, Md.

Oxidation behavior of several enameling irons during the initial stages of fire was investigated, and the effect of ground-coat refractoriness and of mill additions on the oxidation of enameling iron was studied. A rather wide variation in oxidation rate between different enameling irons was noted. The mill formula and the type of ground coats used were also found to influence oxidation behavior.

12:00 M.–12:30 P.M.

6. Laboratory Control of Drawing Compounds on Porcelain Enamel Metals

By D. J. Benoliel: Quaker Chemical Products Corporation, Conshohocken, Pa.

A series of laboratory methods is given to check drawing compounds before they are put into actual production. Complete details are given on methods which measure (1) the value of the compound as a die lubricant, (2) the value of the compound as a rust preventive, (3) the cleanability of the compound from a metal surface, and (4) the amount of carbon and scale that remains on work after a welding process.

A description is given of the apparatus, the preparation of samples, methods of testing, and the evaluation of results. These methods serve only as a guide to give a comparative evaluation between drawing compounds. After continued use in one laboratory, standards may be set up that will show immediately which compounds fall below a minimum given standard. Compounds which fall below this minimum standard need not be tried on a production basis.

ENAMEL DIVISION PROGRAM (continued)

Royal York Hotel: Banquet Hall

Tuesday Afternoon, April 9, 1940: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

7. Effects of Lithia Replacing Soda in Porcelain Enamel

By M. O. Lewis: Department of Ceramics, Rutgers University, New Brunswick, N. J.

Lithia, as lithium carbonate, is substituted systematically for soda in the composition of a moderately opaque, white cover enamel, and its effects on fusibility; thermal expansion; surface abrasion, crushing, and acid resistances; reflectance; and gloss are determined. Spodumene and lepidolite are tried as batch constituents.

2:30–3:00 P.M.

8. Spectrographic Analysis of Vitreous Enamels

By Eugene Wainer and Eugene M. Dubois: Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

A detailed résumé is given of spectrographic methods developed in this laboratory over the past few years for the practical analysis of vitreous enamels and frits. The complete method is illustrated by slides, showing each step in the procedure and using five frits of varying composition as examples.

3:00–3:30 P.M.

9. Reactions Taking Place During the Smelting of a Superopaque Antimony Enamel

By Burnham W. King, Jr., and Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The reactions taking place during the smelting of a typical superopaque antimony enamel were studied by first determining the thermal effects which occur during the smelting of the raw batch and then by investigating the reactions which produce these effects. By this method, it was found that up to 500°F. the chief reaction was the dehydration of the borax. Between 500° and 800°F., the first liquid developed with the melting of the soda niter. Most of the reactions, however, took place from 800° to 1300°F. Soda niter and sodium silicofluoride were decomposed, and the antimony trioxide was oxidized. Above 1300°F., considerable glass was formed, and the enamel gradually became more uniform.

3:30–4:00 P.M.

10. Correction of Multipurpose Reflectometer Data

By R. S. Hunter: National Bureau of Standards, Washington, D. C.

The precision of the multipurpose reflectometer (R. S. Hunter, "Development of a Multiple-Purpose Photoelectric Reflectometer," *Bull. Amer. Ceram. Soc.*, **16** [3] 90 (1937)) is attested by the manner in which it will identify differences in color between samples which are nearly identical. Although its precision is high, accuracy may be attained only by operating the reflectometer so that the effects of sixteen potential sources of error (R. S. Hunter, "Sources of Error in Operation of the Multipurpose Reflectometer," *Jour. Optical Soc. Amer.*, **30**, 89 (1940)) are eliminated by compensation or correction. Several of these sources of error are eliminated by the design of the instrument and the selection of the photocells. Others are eliminated by employing a substitution method during operation and by using as standards specimens spectrally similar to the samples being measured. Scale errors are eliminated by making certain corrections. The sixteen individual sources of error will be noted together with the procedures for detecting them and eliminating their effects.

4:00–4:30 P.M.

11. Discussion of Factors Affecting Reflectance

By Clark Hutchison and Forrest Nelson: Ingram-Richardson Manufacturing Company of Indiana, Incorporated, Frankfort, Ind.

A study of reflectance was made to determine the factors which should be considered to obtain maximum reflectance with a given enamel. The increase in reflectance obtained from fine grinding varied according to the frit and opacifier used. It was found that the proper combination of frit and opacifier should be considered in developing reflectance. The efficiency of the opacifiers varied according to the amount used and was somewhat affected by the blending of frits. The kind of clay used in the mill addition also affected reflectance.

4:30–5:00 P.M.

12. Development of Opacity in Superopaque Enamels

By Burnham W. King, Jr., and Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Using X-ray and microscopic technique, a detailed examination was made of the effect of smelting time and temperature on the crystalline material causing opacity in a typical superopaque antimony enamel. It was found that, although the crystalline antimony compound causing opacity in such enamels dissolved very slowly at smelting temperatures, there was a decided increase in the particle size of the opacifier particles as the time of smelting was increased. The presence of calcium was found to be beneficial in producing opacity.

ENAMEL DIVISION PROGRAM (continued)

Royal York Hotel: Banquet Hall

Wednesday Forenoon, April 10, 1940: 9:00 A.M–12:00 M.

9:00–9:30 A.M.

13. Method of Determining the Thickness of the Acid-Resistant Portion of an Enamel Coating

By L. Shartsis and W. N. Harrison: National Bureau of Standards, Washington, D. C.

In formulating a Federal specification for formed-metal plumbing ware, a stated minimum depth for the acid-resistant layer of enamel was prescribed, and a test for determining such depth was developed. This test consists of the following steps:

(1) Expose an oblique section of the enamel coating, at least 5 cm. long and extending about 1 cm. in width, from the original enamel surface to the iron by grinding at approximately 5 degrees to the flat surface of the enamel.

(2) Mark the boundary between the original surface of the enamel and the oblique section with a material that will not disappear on refiring.

(3) Measure accurately the approximate 1-cm. width of the oblique section at several places.

(4) Refire the specimen just sufficiently to give a fire polish to the oblique section.

(5) Immerse the oblique section in an acid solution for 15 minutes and remove and dry.

(6) Rub the entire oblique section with a colored wax china-marking pencil.

(7) Rub the wax-coated oblique section with a dry cloth which will remove the wax from the acid-resistant portion of the section but not from the portion etched by the acid.

(8) Measure accurately the distance between the boundary marked as in (2) and the etched portion of the section referred to in (7) at the same places measured for step (3). The ratio of these averaged measurements gives the fraction of the oblique section occupied by acid-resistant enamel. Multiply this fraction by the total enamel thickness determined with a suitable gauge. The product represents the thickness of the acid-resistant portion of the enamel layer.

9:30–10:00 A.M.

14. Practical Thickness of Acid-Resisting Enamel Coatings

By G. H. Spencer-Strong: Porcelain Enamel & Manufacturing Company, Baltimore, Md.

The effect of the firing cycle, fluidity of enamel glasses, water content of enamel slips, method of application, fineness of grind, and opacifiers on the actual thickness of partial acid-resisting enamel coatings as measured by the Shartsis and Harrison method is discussed. The results of this study appear to explain the failure of highly acid-resisting enamels to produce satisfactory acid resistance in some enameling plants.

10:00–10:30 A.M.

15. The Solubility of a Zirconium Oxide Opacifier in Enamel Glasses and Its Effect on the Refractive Index and Fusibility of the Glass

By A. I. Andrews and R. W. Gates: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The solubility of a zirconium oxide opacifier was determined by fusion in enamel glasses and then by heat-treating at enameling temperatures and noting crystallization. It was found that increases of alumina, zinc oxide, and calcium oxide in the glasses caused decided decreases in the solubility of the zirconium oxide opacifier. The fusion temperatures of the enamels were raised by the solution of zirconium oxide.

10:30–11:00 A.M.

16. Further Progress in Developing a Photoelectric Method for Measuring Color Difference

By Richard S. Hunter: National Bureau of Standards, Washington, D. C.

At the Forty-First Annual Meeting of The American Ceramic Society (1939), an equation was presented by which the amount of color difference between two samples could be computed from multipurpose-reflectometer data (R. S. Hunter, "Progress in Developing a Photoelectric Method for Measuring Color Differences," *Bull. Amer. Ceram. Soc.*, **18** [4] 121 (1939)). Experience in the measurement of color differences by this means and the development of an improved amber filter have made possible an improvement of the equation given a year ago. The revised equation is

$$\Delta E = f_g\sqrt{50G^{1/2}(\overline{\Delta\alpha}^2 + \overline{\Delta\beta}^2)10^4 + [k_L\Delta(G^{1/2})10^2]^2}$$

Wherein $\alpha = \dfrac{2.5(A-G)}{A+6G+3B}$

$\beta = \dfrac{(G-B)}{A+6G+3B}$

A, G, and B = apparent reflectances measured with the amber, green, and blue tristimulus filters, respectively.

f_g relates to gloss of sample surfaces.

k_L = constant, giving weight to be applied to lightness component of color difference relative to that given to chromaticity component.

Examples of the use of the new equation to measure color-tolerance samples and to determine the whiteness of near-white porcelain enamels will be described. Samples of computation forms will be available.

11:00–11:30 A.M.

17. Effect of Residual Color on Consumer Rating of Porcelain Enamel Whites

By John W. Iliff: Harshaw Chemical Company, Cleveland, Ohio

Although reflectometers are widely used to rate numerically the comparative whiteness of porcelain enamels, these instruments occasionally show values in disagreement with a careful visual comparison. To find the reason for this disagreement, a survey was made to determine the effect of residual color on the consumer rating of porcelain enamel whites. A series of twelve white plaques was made ranging from 67 to 75% in reflectance, from 478 to 485 mμ in dominant wave length, and from 1.6 to 5.6% in residual color, these specifications being determined from curves run upon a Hardy G. E. recording spectrophotometer. The twelve plaques were submitted to thirty-six women who were to arrange them in their order of whiteness. The arrangements were compared statistically, and the whites were rated in the order of acceptance. Residual color was found to have an important effect on apparent whiteness, and of these typical porcelain enamel whites, those most highly colored (blue) were preferred.

11:30 A.M.–12:00 M.

18. Color and Light Sources

By Norman Macbeth and Benjamin J. King: Macbeth Daylighting Corporation, New York, N. Y.

The essentials of light, vision, and color as directly connected with color matching are briefly discussed. A summary is given of why we see, especially of why we see color. Various light sources which have been developed are covered, particularly in the exact reproduction of natural daylight.

Color as a sensation is discussed as well as the equipment that has been scientifically designed for exact color matching, both spectrophotometric and visual and for laboratory production.

Enamel Division Business Luncheon

Royal York Hotel: Banquet Hall

Wednesday Noon, April 10, 1940: 12:00 M.–2:00 P.M.

ENAMEL DIVISION PROGRAM (continued)

Royal York Hotel: Banquet Hall

Wednesday Afternoon, April 10, 1940

2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

19. Electrolytes in Acid-Resisting Enamels

By Fred A. Petersen and Clark Hutchison: Ingram-Richardson Manufacturing Company of Indiana, Incorporated, Frankfort, Ind.

The effect of various electrolytes on the acid resistance, set, and defects of acid-resisting enamels was studied. The defects encountered were scumming, pitting, and shoreling. (1) It was found that insufficient set caused scumming and that this defect was aggravated by aging the enamel. This defect may be eliminated by increasing the set of the enamel. (2) One of the enamels studied had a decided tendency to shoreline whenever a sulfate or an electrolyte containing the sulfate radical was used. (3) The pitting tendency of one enamel was traced to the high soluble salt content of the mill liquor. This defect was eliminated by spraying the enamel at a high gravity or by applying the acid-resisting enamel in a heavier coating.

Some of this work has been continued in regular plant practice, and a discussion of this phase of the work is included.

2:30–3:00 P.M.

20. Calcium Oxide as a Set-Up Agent for Acid-Resisting Enamels

By George Sirovy and E. P. Czolgos: Century Vitreous Enamel Company, Chicago, Ill.

A study was made of the effects produced on the set, texture, color, and resistance of acid-resisting enamels by calcium oxide in the mill addition. The results are discussed.

3:00–3:30 P.M.

21. Some Physical Properties of Sheet-Steel Enamels Affecting Hairlining

By E. E. Bryant: Ferro Enamel Corporation, Cleveland, Ohio

A general discussion is presented of hairlining, covering the possible effects of coefficient of expansion and dry film condition. The analogy between the action at the brushed or scored edge of an enamel coating and the action at a hairline is shown. Some properties which resist hairlining are shown by cross-section views of brushed edges. Wetting of the undercoat, the solution of the cover coat and the undercoat in each other, and the fluidity of the different coatings of enamel are considered.

3:30–4:00 P.M.

22. Some Factors Influencing Dry-Beading Waterlines

By R. J. Whitesell: Röhm & Haas Company, Incorporated, Philadelphia, Pa.

The effect of milling and application variables on the dry-beading defects of two types of kitchenware enamels was determined. The tearing adjacent to the bead was influenced by the same factors that govern the usual tearing encountered in all enamels. Blistering was controlled by the quantity and nature of the soluble salts deposited in the waterline. Potassium carbonate was a primary cause of blistering. Under certain conditions, the addition of sodium nitrite or sodium thiosulfate either to the cover enamel or to the beading enamel eliminated blistering.

4:00–4:30 P.M.

23. Some Observations on Cover-Coat Sagging

By Lyman C. Athy: Porcelain Enamel & Manufacturing Company, Baltimore, Md.

The effect of the refractoriness of cover coats and ground coats and firing treatment on the sagging tendencies of cover-coat enamels was determined. A study of the enamel structure as revealed by metallographic section was made. The refractoriness of ground coats appears to influence sagging tendencies more than any other factor.

4:30–5:00 P.M.

24. Molybdenum in Enamels: I, Adherence Produced with Molybdenum Compounds

By Karl Kautz: Climax Molybdenum Company, Langeloth, Pa.

When definite types of white or clear enamels are milled with certain molybdenum compounds, light-colored ground coats are produced. These ground coats show excellent adherence when applied in the usual manner to deeply pickled sheet steel. Firing may be done at 1600° or at 1500°F. according to the type of enamel. The properties of molybdenum compounds, the problems involved in their use, the types of compounds that produce adherence, the types of enamels that work successfully, and a possible explanation of how these compounds function to produce adherence are also discussed.

ENAMEL DIVISION PROGRAM (concluded)

Royal York Hotel: Banquet Hall

Thursday Forenoon, April 11, 1940

9:30 A.M.–12:30 P.M.

9:30–10:00 A.M.

25. History of the Development of Mill-Addition Opacifiers for Vitreous Enamels

By Harold D. Prior: Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

A survey of the literature is given, showing the progress of the industry in the development of mill-addition opacifiers, especially with respect to the replacement of tin oxide. The work done along these lines is summed up from the viewpoint of the user and of the supplier from the beginning of its interest to the enameling industry to the present-day status.

10:00–10:30 A.M.

26. Use of Nepheline Syenite in Sheet-Steel Enamels

By C J. Koenig: Engineering Experiment Station, Ohio State University, Columbus, Ohio

Data are given on the use of nepheline syenite as an enamel frit constituent and as a mill addition to sheet-steel ground-coat enamels.

10:30–11:00 A.M.

27. A Study of the Effects of Soluble Salts Present in Enamel Mill Liquors

By T. L. Hurst and A. I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Studies were devoted entirely to determining the actual, fundamental causes of tearing and crawling in enamel cover coats. The influence of some soluble salts present in cover-coat enamels on enamel film strength has been revealed, and a theory regarding the mechanism of tearing

has been developed. The function of some salts, particularly sodium nitrite and sodium hydroxide, in eliminating tearing was studied, and the manner in which these salts improved enamel film strength is reported.

11:00–11:30 A.M.

28. Method of and Apparatus for Studying the Physical Properties of Viscous Liquids

By J. E. Rosenberg and W. E. Naylor: The O. Hommel Company, Pittsburgh, Pa.

The physical properties of viscous liquids and suspensions which are useful to the enameler are (1) specific gravity, (2) viscosity or mobility, and (3) yield point. All of these properties are determined simply by the use of a hydrometer. To obtain the true specific gravity, the vessel containing the liquid is vibrated so that the hydrometer reaches the true value. The mobility or viscosity is measured by the rate at which the hydrometer falls in the liquid. The yield point is determined by the point to which the hydrometer sinks in the liquid when the liquid is not vibrated. Special modifications of the instrument are necessary.

11:30 A.M.–12:00 M.

29. Viscous Properties of Soda-Boric Oxide-Silica Glasses at Temperatures from 900° to 1500°F.

By Burnham W. King, Jr., and Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The viscosities of a number of soda-boric oxide-silica glasses were approximately determined in the temperature range from 900° to 1500°F. These were obtained by noting the deformation of small glass rods. Three steps were observed in the process of deformation which occurred at definite viscosities, the absolute magnitudes being obtained by correlation with glasses of known properties.

12:00 M.–12:30 P.M.

30. A Summary of Student Theses

By C. R. Amberg: Department of Ceramic Engineering, New York State College of Ceramics, Alfred, N. Y.

(*A*) Effect of the Plasticity of Clays on the Dry Film Strength of an Enamel (thesis by A. C. Francisco). Clays of varying dry strengths were selected, and the film strength of the enamel in which they were employed was determined by flexing the dried enameled sheets through varying angles before firing.

(*B*) Cleaning Metal Stock by the Tainton Nascent Sodium Process (thesis by R. H. Hammell). The Tainton process, using molten caustic soda and a low-voltage direct current, was compared with the usual methods of cleaning enamel sheets.

(*C*) A Comparison of Control Constants for Double- and Single-Nickel Salt Dips (thesis by K. H. Sandmeyer). Factors of temperature, time of dip, and the concentration and pH of the solution have been investigated.

(*D*) The Effect of Varying Composition on the Abradability of Enamels (thesis by S. C. Orr). The abradability of enamel glasses was studied by the method developed by S. R. Scholes for use on glass. The borax, quartz, and feldspar contents were varied.

(*E*) The Effect of Solution of Iron Oxide on the Coefficient of Expansion of Enamels (thesis by W. Paquin). Ferroso-ferric oxide was dissolved in enamel frit, and the change in coefficient of expansion was determined by the use of the interferometer.

(*F*) Enamels in Plated Silverware Design (thesis by E. H. Wallace). An enamel was developed which fused at 1090°F. and had reasonable resistance to the acids and alkalis encountered in service.

Supplementary Title

31. A Case History of Scratch Blisters

By James D. Tetrick: Baltimore Enamel & Novelty Company, Baltimore, Md.

An outbreak of scratch blisters is described, and the results of a study of pickle-room practice and its relation to the formation of the scratch blisters are given.

GLASS DIVISION PROGRAM

Chairman: N. W. Taylor, Department of Ceramics, Pennsylvania State College, State College, Pa.
Secretary: S. R. Scholes, Department of Glass Technology, New York State College of Ceramics, Alfred, N. Y.
Program Committee
W. R. Lester, Chairman; Maryland Glass Corporation, Baltimore, Md.
A. K. Lyle, Hartford-Empire Company, Hartford, Conn.

Royal York Hotel: Ball Room

Tuesday Forenoon, April 9, 1940: 9:30 A.M.–12:00 M.

9:30–9:50 A.M.

1. Specific Refraction of Glasses and Glassforming Oxides

By J. C. Young and A. N. Finn: National Bureau of Standards, Washington, D. C.

Seven of the better-known specific refraction ratios are examined for the comparative applicability to glass. It is shown by a comprehensive statistical treatment of available data (including many new data) that, of these ratios, only the Gladstone-Dale possesses to a satisfactory degree each of the following desirable features: (1) it varies linearly with chemical composition and with the square of the wave number of the incident light; (2) for a given composition and wave length of light, it is substantially the same for both the vitreous and crystalline states; and (3) for the vitreous state, it is independent of thermal history. Gladstone-Dale factors for forty-seven oxides as constituents of glass are given. These factors are shown to be related to the periodicity of the elements.

9:55–10:10 A.M.

2. The Refractive Indices of Various Substances

By G. W. Morey: Geophysical Laboratory, Washington, D. C.

Progress in lens design is dependent on the materials available to the designer. The range of refractive index and dispersion in transparent materials, i.e., isotropic crystals, and ordinary liquids is similar to that of glasses with the exception of a few substances of notably different properties. The range of optical properties in crystals and liquids, including glasses, will be shown in slides.

10:15–10:35 A.M.

3. The Relation of Density and Refractive Index to the Composition of Glass

By Kuan-Han Sun and Alexander Silverman: Department of Chemistry, University of Pittsburgh, Pittsburgh, Pa.

The density and refractive index and their relationship to the composition of glass are discussed. The subject is treated from the standpoint of additive properties based on composition both as to linear and collective or complex functions. Not only are these applied in the rapid checking of constancy of composition in practice but from the standpoint of possible changes in properties through partial changes of individual components. There is the further possibility of tying in constitution with composition so that a structural analysis may result. The article serves as a review of existing literature and elaborates the possibility of expansion on published data.

10:40–11:20 A.M.

4. Reducing the Reflection from Glass

By C. Hawley Cartwright: Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

Coating glass with a homogeneous film will reduce the reflection of green light to zero when the film satisfies the conditions, viz., (1) when the index of refraction is 1.23 and (2) when the optical thickness is 1370 A. The first condition cannot be fulfilled exactly with any rugged film because it requires a material having an abnormally low index of refraction. Even when this condition is satisfied only approximately with evaporated films of the metallic fluorides, a marked decrease in the reflection from glass is possible. The second requirement is of paramount importance and is easy to fulfill experimentally. Although the reflectance is a minimum for only one wave length, it is greatly reduced throughout the visible spectrum. Some of the metallic fluorides can be hardened so that they will withstand weather and abrasion. The evaporation method limits the use of the metallic fluorides to relatively small surfaces.

Another method to reduce the reflection from glass consists of using a combination of two films so applied that the sum of the three reflection vectors add to zero. Such films may consist of TiO_2 and SiO_2, both of the correct thickness. These films may be applied in air and seem applicable for treating large surfaces of glass.

11:25–11:40 A.M.

5. Rapid Methods for Detecting Small Amounts of Coloring Oxides in Some Batch Materials

By F. W. Glaze and A. N. Finn: National Bureau of Standards, Washington, D. C.

For certain purposes, such as the manufacture of optical glass, very small amounts of coloring oxides in the batch materials are disastrous. Although small in actual percentage, objectionable amounts of coloring oxides in potassium carbonate and arsenic oxide have recently been encountered. Methods for detecting about 0.001% of nickel and cobalt oxides will be discussed.

11:40 A.M.–12:00 M.

6. Organization of Glass Research in Graduate Schools

By Nelson W. Taylor: Department of Ceramics, Pennsylvania State College, State College, Pa.

Nearly one-half of the research reports presented before the Glass Division since its formation in 1919 have originated in college or university laboratories. Most of the men trained by these researches are now in the glass industry. The advantages of a closer cooperation between industry and the schools in the training of graduate students in the basic sciences and in the methods of research in glass technology will be discussed.

GLASS DIVISION PROGRAM (continued)

Royal York Hotel: Ball Room

Tuesday Afternoon, April 9, 1940: 2:00 P.M.–4:45 P.M.

2:00–2:20 P.M.

7. Effect of Certain Metallic Oxides on Rate of Heat Penetration of Molten Glass

By C. W. Parmelee, R. L. Shute, and A. E. Badger: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The greater ease of melting colored or opaque glasses may be the result of two effects, viz., (1) a chemical action due to the fluxing power of colorant or opacifying agent and (2) a physical action resulting from the increased absorption of heat radiation.

The first effect was studied by noting differences in the fining of glasses which contain various additions of iron oxide. Tests on heat absorption were made by measuring the temperature gradient existing in various molten glasses under controlled conditions.

2:25–2:55 P.M.

8. Melting Rate of Soda-Lime-Silica Glasses as Influenced by Composition, and Effect of Several Minor Constituents on Melting Rate of Such Glasses

By J. C. Potts: Owens-Illinois Glass Company, Toledo, Ohio

Using the disappearance of batch as a criterion of melting, a comparison of the rate of melting of twenty-six soda-lime-silica glass compositions has been made. Then, using the composition of 14% Na_2O·12% CaO·74% SiO_2 ($+R_2O_3$) as a base glass, the effect of the substitution of small amounts of B_2O_3, BaO, SO_3, etc., on the rate of melting was studied. The raw materials used were soda ash, calcite, limestone, silica sand, dehydrated borax, barytes, salt cake, Chile saltpeter, ammonium sulfate, and fluorspar.

3:00–3:15 P.M.

9. Reaction Between Metals and Molten Glass

By A. E. Badger and B. Bard: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The reaction between metals (and a few nonmetals) and a molten soda-lime-silica glass was observed by heating the materials contained in small crucibles in an atmosphere of hydrogen to prevent oxidation of the metal. The results of about twenty tests are presented.

3:20–3:40 P.M

10. An Isobar at 3000 Pounds in the System H_2O–Na_2O–CaO–SiO_2

By G. W. Morey: Geophysical Laboratory, Washington, D. C.

This is an informal discussion of the progress of work on this system with the presentation and explanation of some unexpected results.

3:45–4:15 P.M.

11. Effect of Alumina on Devitrification of Soda-Dolomite Lime-Silica Glasses

By W. B. Silverman: Owens-Illinois Glass Company, Toledo, Ohio

The effect of the substitution of Al_2O_3 for Na_2O, CaO and MgO (in the ratio in which they occur in dolomite lime), and SiO_2 on the liquidus temperatures and phase relations for glasses lying within the composition range Na_2O, 12 to 16%; CaO·MgO, 0 to 20%; SiO_2, 63 to 78%; and Al_2O_3, 0 to 10% has been determined. The results on 116 individual determinations are given. Devitrite is the primary phase in but few glasses. Several of the compositions studied could not be devitrified.

4:15–4:30 P.M.

12. Effects of Lithia in Glass

By C. W. Parmelee and Felix Fraulini: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The purpose of this investigation was a study of the physical properties of glasses produced by substituting 5, 10, and 13% of lithia for equivalent percentage weights of soda in a glass of the composition silica 73%, lime 12%, and soda 13%. The replacements in the order stated gave the following results: (1) the thermal expansion coefficients increase; (2) the indices of refraction increase; (3) the densities decrease; (4) the surface tensions (drop method) of the softened glasses (*ca.* 500°–600°C.) decrease; (5) the glasses tend to devitrify; (6) the time of fining decreases; and (7) the softening temperatures decrease.

4:30–4:45 P.M.

13. The System Sodium Disilicate–Barium Disilicate

By K. T. Greene and W. R. Morgan: Department of Ceramics, Rutgers University, New Brunswick, N. J.

The phase equilibrium relations in the system Na_2O·-$2SiO_2$–BaO·$2SiO_2$ were studied by means of the quenching method. The refractive indices of the glasses were also determined, using the microscopic immersion method.

GLASS DIVISION PROGRAM (continued)

Royal York Hotel: Ball Room

Wednesday Forenoon, April 10, 1940

9:30 A.M.–12:00 M.

9:30–9:45 A.M.

14. Electrical Conductivity of Glass

By A. E. Badger and J. F. White: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The electrical conductivity of glasses was measured at 400°C., using a frequency of 1000 cycles. Two series of glasses were measured, one consisting of soda-lime-silica glasses, whereas in the other, various oxides were incorporated in the glass. Diagrams of the results of measurements are given.

9:45–10:05 A.M.

15. Volume Resistivity of Glass

By W. T. Gray: Corning Glass Works, Corning, N. Y.

Resistivities of several glasses have been measured at temperatures above the softening point. Resistances were measured between platinum rod electrodes with 60-cycle and 1000-cycle current. Values were converted to absolute resistivities by calibrating the cell with a standard electrolytic solution. The effect of the cell constant was minimized by varying the immersion depth of the electrodes.

10:05–10:20 A.M.

16. Effect of Heat Treatment on the Dielectric Constant of Some Na_2O–B_2O_3–SiO_2 Glasses

By J. M. Humphrys and W. R. Morgan: Department of Ceramics, Rutgers University, New Brunswick, N. J.

The results are presented of a study of the effect of heat treatment on the density, refractive index, and dielectric constant of a number of simple Na_2O–B_2O_3–SiO_2 glasses. An attempt is made to interpret the effects in terms of the structure of the glasses. (Studies made under an Edward Orton, Jr., Ceramic Foundation Fellowship.)

10:25–10:50 A.M.

17. X-Ray Study of Potash-Silica Glass

By J. Biscoe, M. A. Druesne, and B. E. Warren: Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

X-ray diffraction studies of potash-silica glasses indicate a random network structure similar to that found in soda-silica glass. Each silicon is tetrahedrally bonded to four oxygens at a distance of about 1.63 A. Part of the oxygens are bonded to two silicons and part only to one silicon. The potassium ions K^+ are randomly arranged in the network holes and surrounded on the average by about ten oxygen atoms.

10:55–11:20 A.M.

18. X-Ray Study of Lime-Borate and Lime-Phosphate Glasses

By J. Biscoe, A. G. Pincus, and C. S. Smith, Jr.: Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

X-ray diffraction patterns of two lime-phosphate glasses and one lime-borate glass have been made. Radial distribution curves have been deduced from these patterns by means of a Fourier analysis. The peaks in these curves indicate interatomic distances that are in agreement with such distances in crystals.

In the lime-phosphate glasses, each phosphorous is tetrahedrally surrounded by four oxygens at a distance of about 1.58 A, and every oxygen atom is bonded to either one or two phosphorous atoms in such a way as to produce a continuous random network. The calcium atoms lie in the holes of this network and have about seven oxygens as nearest neighbors.

The first peak in the lime-borate distribution curve lies at about 1.48 A, which is to be compared with 1.36 and 1.53 A, the boron-oxygen distances in triangularly and tetrahedrally coordinated boron, respectively. From this it seems reasonable to suppose that some of the borons are surrounded by three and some by four oxygens.

11:25–11:40 A.M.

19. Atomic Consideration of Immiscibility in Glass Systems

By B. E. Warren and A. G. Pincus: Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

An attempt is made to apply the results of crystal chemistry to the problem of immiscibility in glass systems. In a lime-silicate glass, each silicon is tetrahedrally bonded to four oxygens, and part of the oxygens are bonded to two silicons and part only to one silicon. From the point of view of the Pauling rules, the single-bonded oxygens have an unsatisfied negative valence of one. The calcium ions, Ca^{++}, try to surround themselves by single-bonded oxygens. Assuming that for stability each single-bonded oxygen must bond to at least two calcium ions and using known interatomic distances, an approximate minimum lime content for miscibility of 33% is calculated. Similar considerations are applied to other systems including the ternary system Na_2O–B_2O_3–SiO_2. The results are in agreement with experiment within the limits of the approximations involved and therefore seem to give some insight into the structural chemistry of miscibility involved.

11:45 A.M.–12:00 M.

20. Some Observations on the Thermal Expansion and Melting Point of Crystalline Boric Oxide

By Donald Hubbard: National Bureau of Standards, Washington, D. C.

Interferometer determinations of the thermal expansion on one sample of B_2O_3 crystals indicate a slight irregularity between 150° and 200°C., possibly attributable to surface adsorption of water. Disregarding this, the coefficient of linear expansion was about $15(10)^{-6}$ between room temperature and 400°C. Between 400° and 450°C., the coefficient increased $6(10)^{-6}$. At 451°C., the specimens collapsed abruptly, indicating a melting point. This temperature agrees with the 450° ± 2 reported by Kracek, Morey, and Merwin as the melting point of the compound.

Glass Division Luncheon and Business Meeting

Royal York Hotel: Ball Room

Wednesday Noon, April 10, 1940

12:15 P.M.–1:45 P.M.

GLASS DIVISION PROGRAM (concluded)

Royal York Hotel: Ball Room

Wednesday Afternoon, April 10, 1940

2:00 P.M.–4:15 P.M.

2:00–2:15 P.M.

21. Modern Grecian Glassware

By Alexander Silverman: Department of Chemistry, University of Pittsburgh, Pittsburgh, Pa.

This paper is devoted to the history of the chemical and glass syndicate of Greece, which probably has the largest capital investment of any organization of its type in the Near East. This corporation has employed artists who have developed unusual modern designs in glass, based on some of the ancient Egyptian, Roman, and Grecian designs. The talk will be illustrated with lantern slides.

2:20–2:40 P.M.

22. Fracture Studies by Direct Photographic Enlargements

By E. L. Hettinger: Willson Products, Incorporated, Reading, Pa.

By making a series of enlargements of fractured pieces of glass and knowing one or two of the analyses, the difference in the composition of the glass may be checked, even though the refractive indices may be the same.

2:45–3:15 P.M.

23. Durability of Optical Glass

By Frank L. Jones: Mellon Institute of Industrial Research, Pittsburgh, Pa.

The experimental study of various laboratory methods for measuring the durability of optical glass is discussed,

including the relation of laboratory results to exposure tests in both temperate and tropical climates and the use of laboratory test results for guiding the development of new glasses.

3:20–3:50 P.M.

24. Effect of Time and Temperature on Accelerated Chemical Durability Tests Made on Commercial Glass Bottles, Part II

By F. R. Bacon and O. G. Burch: Owens-Illinois Glass Company, Toledo, Ohio

The effects of storage of solutions in glass bottles at room temperature are compared with the results of the various accelerated tests with corresponding solutions in the first paper of this series (*Jour. Amer. Ceram. Soc.*, **23** [1] 1–9 (1940); correction on p. 56, February issue). The acid tests at room temperature are in good agreement with those at higher temperatures.

Relative resistances of glass bottles, as shown by accelerated tests with water, roughly parallel relative resistances appearing in room-temperature storage of unbuffered, neutral materials only if the various amounts of extraction are approximately the same at both temperatures. Under this circumstance, the correlation improves as the temperature of test approaches the temperature of storage.

The tendency of bottles to produce flakes or insoluble matter in alkaline solutions bears no direct relation to the amount of soluble material extracted by such solutions.

3:55–4:15 P.M.

25. A Comparison of Titration and Conductivity Methods for Determining the Relative Solubility of Glass

By E. H. Hamilton, Donald Hubbard, and A. N. Finn: National Bureau of Standards, Washington, D. C.

When the alkalinities of aqueous extracts of bottles (determined by direct titration) were plotted against the specific conductivities of the respective extracts, a linear relation was obtained for ten out of thirteen different bottles. "Back titers" of the filtered extracts (flakes removed) versus their conductivities gave a similar straight line except for the three bottles already noted. The relation between "back titers" and conductivities of unfiltered extracts was variable. Results that indicate the determination of only one property of extracts, such as alkalinity or conductivity, may lead to erroneous conclusions concerning relative "solubility."

MATERIALS AND EQUIPMENT DIVISION PROGRAM

Chairman: William Malkin, B. F. Drakenfeld & Company, Inc., East Liverpool, Ohio
Secretary: W. H. Emerson, Homer Laughlin China Company, Newell, W. Va.
Program Committee
F. E. Finch, Chairman; Hardinge Company, York, Pa.
R. G. O'Meara, Bureau of Mines, Tuscaloosa, Ala.
S. S. Cole, Titanium Pigment Company, Incorporated, South Amboy, N. J.

Royal York Hotel: Hall B

Tuesday Forenoon, April 9, 1940: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

1. Concentration of Feldspathic Waste from a Titanium Mine near Roseland, Va.

By D. I. Smith, R. G. O'Meara, and T. N. McVay: University of Alabama, University, Ala.

The beneficiation of the feldspathic waste from a titanium mine near Roseland, Virginia, is discussed. This waste, which is mainly sodic plagioclase, quartz, and an iron-bearing mineral gedrite, contains about 5.3% Fe_2O_3. By magnetic concentration, 73% of the ore was recovered in a feldspar-quartz mixture with an iron content of 0.81% Fe_2O_3. From this nonmagnetic product, between 85 and 90% of the feldspar with an iron content of 0.41 to 0.52% Fe_2O_3 was recovered by agglomerate tabling and flotation. Examination of the feldspar concentrate, however, showed that iron stains and iron-bearing impurities of microscopic size in the feldspar prevented the separation of a feldspar concentrate with less than 0.36% Fe_2O_3.

10:00–10:30 A.M.

2. Some Experiments in Dry Mixing

By J. F. McMahon: New York State Ceramic Experiment Station, Alfred, N. Y.

Dry-mixed bodies equal to or better in quality than blunged bodies were produced by means of special treatments. The influence of dry mixing on the properties of plastic-molded as well as dust-pressed bodies was investigated.

10:30–11:00 A.M.

3. Process to Recover Kyanite and Accessory Commercial Minerals from North Georgia Schist

By Walter B. Boyd: Southern Mining and Milling Company, Clarkesville, Ga.

North Georgia kyanite schist contains from 4 to 8% kyanite, about 25% commercial mica, small quantities of graphite as commercial products; and silica, iron minerals, and slimes as impurities. The kyanite is separated from the gangue by mulling in patented mullers, screening, and jigging; the mica is recovered by settling, screening, and tabling; and the graphite is obtained by flotation.

11:00–11:30 A.M.

4. Progress in the Removal of Iron-Bearing Minerals from Clays and Sands by Froth Flotation

By D. W. McGlashan and N. W. Taylor: Department of Ceramics, Pennsylvania State College, State College, Pa.

The first step in flotation, as in the magnetic method or other methods of beneficiation, must be mechanical liberation of mineral particles attached to one another. Following this, suitable flotation reagents must be found. The results are presented on the removal by xanthate reagents of pyrite from nodular flint fire clay and from facebrick clay. An example is given of the beneficiation of glass sand by the removal of oxidized iron, using other reagents. Some data are also presented showing contrasts in the adsorption of certain flotation reagents by hematite, quartz, and kaolin.

11:30 A.M.–12:00 M.

5. Effect of Heat on the Clay Minerals Illite and Montmorillonite

By R. E. Grim and W. F. Bradley: State Geological Survey Division, University of Illinois, Urbana, Ill.

Samples of three purified illites; one purified montmorillonite; and one natural clay containing montmorillonite, quartz, and limonite were heated at successive temperatures up to 1400°C. X-ray and optical determinations were made on all samples. The changes that take place in the clay minerals illite and montmorillonite when they are heated at various temperatures up to 1400° C. are discussed.

JOINT MEETING: WHITE WARES AND MATERIALS AND EQUIPMENT DIVISIONS

Royal York Hotel: Private Dining Rooms Nos. 1–5

Tuesday Afternoon, April 9, 1940: 2:00 P.M.–5:00 P.M.
(For abstracts of papers, see White Wares Division Program, p. 148 (the numerical order for the Symposium follows that of the White Wares Division Program)

2:00–2:30 P.M.

7. A Simple Method of Evaluating Size Distribution Data

By P. S. Roller: Bureau of Mines, Eastern Experiment Station, College Park, Md.

2:30–3:00 P.M.

8. The Rate of Decomposition of Kyanite at Various Temperatures

By Helen Blair Barlett: A C Spark Plug Company, Flint, Mich.

3:00–3:30 P.M.

9. New Considerations in the Determination of Size Distribution by Fractionating with Air

By P. S. Roller: Bureau of Mines, Eastern Experiment Station, College Park, Md.

3:30–3:45 P.M.

10. Grain-Size Distribution of Ingredients versus Body Properties

By J. H. Koenig: Hall China Company, East Liverpool, Ohio

3:45–4:15 P.M.

11. Discussion on Effects of Particle Size of a Potter's "Flint" and a Feldspar in Whiteware

By R. F. Geller, D. N. Evans, and A. S. Creamer: National Bureau of Standards, Washington, D. C.

4:15–5:00 P.M.

General Discussion

MATERIALS AND EQUIPMENT DIVISION PROGRAM (continued)

Royal York Hotel: Hall B

Wednesday Forenoon, April 10, 1940: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

6. Possible Uses for a Spectrograph in the Ceramic Profession

By C. C. Nitchie: Bausch & Lomb Optical Company, Rochester, N. Y.

The use of the spectrograph as a tool for the analysis of materials has become so firmly established in many industries that it is only natural to believe that it can be of real help to the ceramic chemist. This paper outlines briefly the basic principles of spectrographic analysis, the instruments used, and the methods followed in carrying out both qualitative and quantitative analyses. The particular characteristics of spectrographic analysis that offer advantages over the usual chemical methods are noted, and examples are cited of its use in production control and material inspection.

10:00–10:30 A.M.

7. Investigation and Solution of Problems in Ceramics by Means of a Spectrograph

By H. C. Harrison: Department of Ceramic Engineering, New York State College of Ceramics, Alfred, N. Y.

A brief review of some applications of spectrographic analysis to the solution of problems in ceramics is presented. Apparatus, technique, and some recent developments in spectrographic procedures are discussed.

10:30–11:00 A.M.

8. Spectrochemical Determination of Alkalis in Ceramic Raw Materials

By Morris Slavin: U. S. Bureau of Mines, Eastern Experiment Station, College Park, Md.

The analyses of the five alkali metals by means of the spectrograph present some special problems because their principal lines fall in the long wave-length region of the spectrum. This necessitates using a different instrument and photographic technique from that customarily employed. The type of spectrograph and photographic emulsions best suited to this work are discussed, and a description is given of the general procedure employed and the results obtained.

11:00–11:30 A.M.

9. Spectrographic Analysis of Vitreous Enamel

By Eugene Wainer and Eugene M. Dubois: Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

A detailed résumé is given of spectrographic methods developed in this laboratory over the past few years for the practical analysis of vitreous enamels and frits. The complete method is illustrated by slides showing each step in the procedure, using five frits of varying composition as examples.

JOINT MEETING: WHITE WARES AND MATERIALS AND EQUIPMENT DIVISIONS

Royal York Hotel: Private Dining Rooms Nos. 1–5

Thursday Forenoon, April 11, 1940: 9:00 A.M.–12:00 M.

Symposium on "Substitution of American for Imported Clays in Whiteware Bodies"

Presiding Chairmen: J. R. Beam and W. R. Malkin

For abstracts of papers, see White Wares Division Program, p. 150 (the numerical order for the Symposium follows that of the White Wares Division Program)

9:00–9:15 A.M.

23. Introduction

By Arthur S. Watts: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

9:15–9:40 A.M.

24. Properties of American Kaolin and English China Clays

By T. A. Klinefelter: National Bureau of Standards, Washington, D. C.

9:40–10:00 A.M.

25. Ball Clays in Whiteware Bodies

By V. J. Roehm: Kentucky Clay Mining Company, Alliance, Ohio

10:00–10:15 A.M.

26. Study of Fractionated Whiteware Clays (Preliminary Study)

By F. H. Norton and A. L. Johnson: Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

10:15–10:30 A.M.

27. All-American Sanitary Ware Body

By I. E. Sproat, C. C. Treischel, and E. W. Emrich: R. T. Vanderbilt Company, Incorporated, 230 Park Ave., New York, N. Y.

10:30–10:45 A.M.

28. American Clays in Whiteware

By Hewitt Wilson and Ernest Wilson: Electrotechnical Laboratory, Bureau of Mines, Norris, Tenn.

10:45–11:00 A.M.

29. An All-American Body for Hotel China

By G. A. Loomis: Engineering Experiment Station, Ohio State University, Columbus, Ohio

11:00 A.M.–12:00 M.

General Discussion

REFRACTORIES DIVISION PROGRAM

Chairman: S. F. Walton, Exolon Company, Blasdell, N. Y.
Secretary: Gilbert Solér, Steel & Tube Division, Timken Roller Bearing Company, Canton, Ohio

Program Committee

R. S. Bradley, Chairman; A. P. Green Fire Brick Company, Mexico, Mo.
G. S. Diamond, Electro Refractories & Alloys Corporation, Lackawanna, N. Y.
W. R. McLain, Carnegie-Illinois Steel Corporation, Chicago, Ill.
E. B. Read, American Refractories Institute at Mellon Institute, Pittsburgh, Pa.

Royal York Hotel: Concert Hall

Tuesday Forenoon, April 9, 1940: 9:00 A.M.–12:30 P.M.

FUNDAMENTAL DATA ON REFRACTORIES

Each paper is given a scheduled amount of time for presentation (15 minutes); the remaining 15 minutes permits general discussion.

7:30–9:00 A.M.

Executive Committee Breakfast

9:00–9:15 A.M.

1. Development of Plasticity of Flint and Semiflint Clays with Electrolytes

By E. B. Snyder and R. M. King: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

Typical flint and semiflint clays were obtained from the Missouri, Kentucky, and Pennsylvania regions and were treated for six months with several electrolytes. These treated clays were incorporated in batches, and tests were made to determine what effect the aging with electrolytes had on their physical properties. Pyrometric cone equivalent determinations were made on those treated and untreated clays that showed marked improvement in plasticity to determine whether the cone fusion of the clays had been materially lowered by the addition of the electrolyte.

9:30–9:45 A.M.

2. Use of Differential Thermal Analysis for Grading High Alumina Clays

By F. H. Norton: Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

The differential thermal analysis has been used on a number of high alumina clays of known chemical analysis. The relative amounts of kaolinite, diaspore, and gibbsite have been determined in these clays, and the results have been compared with their chemical analyses. The thermal method will give quantitative results within a small percentage and will supplement the chemical analysis because the actual clay mineral is obtained rather than the total silica and alumina content. This test also has the advantage of being rapid and relatively inexpensive.

10:00–10:15 A.M.

3. The Role of Chemical Thermodynamics in the Study of Refractories

By L. H. Adams: Director, Geophysical Laboratory, Washington, D. C.

10:30–10:45 A.M.

4. A Study of the Refractory Properties of Topaz

By R. S. Bradley and F. W. Schroeder: A. P. Green Fire Brick Company, Mexico, Mo.; and W. D. Keller: Geology Department, University of Missouri, Columbia, Mo.

The effect of heat treatments on the chemical, physical, and mineralogical properties of topaz is described. The samples of topaz were obtained from a deposit of potential commercial importance. Brick made from calcined and uncalcined topaz were tested according to standard A.S.T.M. test methods, and the results are presented.

11:00–11:15 A.M.

5. Physical Properties of Massive Topaz

By A. F. Greaves-Walker: Department of Ceramic Engineering, University of North Carolina, Raleigh Unit, Raleigh, N. C.

11:30–11:45 A.M.

6. Use of Aluminum in the Ceramic Industry: IV, Aluminum Clay Bonds for Silicon-Carbide and Graphite Refractories

By J. H. Kolstad, D. J. Sparler, and H. G. Schurecht: New York State Ceramic Experiment Station, Alfred, N. Y.

By substituting aluminum metal powder and 15% Kentucky ball clay for 30% Kentucky ball clay in bodies containing 70% silicon carbide, the strength was increased 100%. Mixtures containing aluminum metal powder, moreover, were as strong after firing to 1000°C. as when fired to cone 10. The strength of graphite bodies was likewise increased more than 300% by using a mixture of 30 parts of aluminum metal and 70 parts of clay as a bond.

12:00 M.–12:15 P.M.

7. Effect of Water Content and Mixing Time on the Air-Setting Strength of Refractory Mortars Containing Silicate of Soda

By R. A. Heindl: National Bureau of Standards, Washington, D. C.

Results of tests of an Ohio and a Pennsylvania fire clay and three commercial brands of air-setting refractory mortars of the dry type are given. The tests were made to indicate the effect of (1) the water content on the strength of the Ohio clay with and without grog and silicate of soda; (2) the addition of varying percentages of silicate of soda of two different soda-silicate ratios on the strength and pyrometric cone equivalent of the Pennsylvania clay; and (3) the mixing time, up to 20 hours, on the strength of the Ohio fire clay and three air-setting mortars.

REFRACTORIES DIVISION PROGRAM (continued)

Royal York Hotel: Concert Hall

Tuesday Afternoon, April 9, 1940: 2:00 P.M.–5:00 P.M.

Symposium on Basic Refractories

2:00 P.M.

8. Orthosilicates of the Alkaline Earths with Special Reference to Their Uses in the Refractory Field

By Gilbert E. Seil: E. J. Lavino and Company, Norristown, Pa.

This paper is concerned with the orthosilicates of barium, strontium, calcium, and magnesium; mixed orthosilicates; and mixtures of the orthosilicates of the alkaline earth group. The effect of periclase on these types of orthosilicates at elevated temperatures is described, and a complete bibliography is given, including both scientific literature and patents, with an abstract of each reference. The prior art indicating the value to be placed on the previously reported work and a survey of the methods of approach are discussed, distinguishing between haphazard experimentation and carefully considered research. Tabulations are given of the physical properties and chemical compositions of the orthosilicates, including their chemical and mineralogical names, melting points, decomposition points, molecular weights, chemical compositions, crystalline systems, indices of refraction, optical signs, specific gravities, and specific volumes. New data and many illustrations are submitted to show the range of critical temperatures at which reactions take place and at which stabilization is effective. The order of formation is discussed in detail with special reference to the effect of the composition of the starting materials on the rate of reaction and on the critical temperatures at which the orthosilicates are formed.

9. Formal Discussion

By M. Y. Seaton: Westvaco Chlorine Products Corporation, New York, N. Y.

10. Formal Discussion

By John D. Sullivan: Battelle Memorial Institute, Columbus, Ohio

11. Formal Discussion

By Harley C. Lee: Basic Dolomite, Incorporated, Maple Grove, Ohio

General Discussion

REFRACTORIES DIVISION PROGRAM (continued)

Royal York Hotel: Concert Hall

Wednesday Forenoon, April 10, 1940: 9:00 A.M.–12:15 P.M.

9:00–9:15 A.M.

12. Cast Alumina Refractories and Their Use in the Glass Industry

By A. A. Turner and H. N. Baumann: The Carborundum Company, Niagara Falls, N. Y.

The development of cast alumina refractories is briefly described, and the physical and chemical properties of three types of high alumina fusion-cast refractories that have proved commercially useful are given. Such properties as microstructure and glass-refractory interface reactions are discussed in detail, and the use of these refractories with several different types of glass is described.

9:30–9:45 A.M.

13. Laboratory Tests of Some Ladle Lining Refractories

By R. K. Hursh and A. R. Lesar: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Laboratory slagging tests with open-hearth slag were made in a rotating bath-type furnace and in one in which powdered slag was applied through a rotating burner.

10:00–10:15 A.M.

14. Mineral Development in Brick of the Sixty Per Cent Alumina Class

By C. L. Thompson and C. Burton Clark: Harbison-Walker Refractories Company, Pittsburgh, Pa.

The mineral development in brick of commercial firing, as received and after reheating to 1500°, 1600°, 1670°, and 1725°C., was studied with the polarizing microscope.

10:30–10:45 A.M.

15. Notes on Pyrometric Cone Equivalent Determinations

By Earl C. Petrie: Refractories Fellowship, Mellon Institute of Industrial Research, Pittsburgh, Pa.

This work relates to the technique involved in determining the P.C.E. of refractory materials. It is common practice to use organic binders in forming test cones, and it has been found that these are a cause for the bloating of some clays during the heat-up period of the furnace. Such bloating prevents an accurate determination of the end point. It has been found necessary to pay particular attention to the material used in making the cone plaque when determining the P.C.E. of high-alumina samples. Certain materials ordinarily thought of as being sufficiently refractory and satisfactory for this purpose can be a cause of low P.C.E. values.

11:00–11:15 A.M.

16. The Effect of Mineralizers on Underload Refractoriness of Some Bodies

By R. K. Hursh and A. J. Shorter: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The effect of various mineralizers on the underload refractoriness of mixtures of fire clay with fused alumina, with diaspore, and with flint clay was observed by heating under a compressive load of 50 lb. per sq. in. until the deformation reached 10%.

11:30–11:45 A.M.

17. A Gas-Fired High-Temperature Test Kiln

By C. L. Thompson and Herman G. Wilcox: Harbison-Walker Refractories Company, Pittsburgh, Pa.

A high-temperature test kiln with a hearth 30 by 40 inches is described. The kiln is fired with premixed natural gas and air at atmospheric temperature. It is capable of maintaining temperatures above 1725°C. Two features of the kiln are quiet operation and uniform temperature over the hearth.

12:00 M.–12:15 P.M.

18. Laboratory Melting of Fluid Slags and Glasses Without Contamination

By H. M. Davis: Department of Ceramics, The Pennsylvania State College, State College, Pa.

A sintered briquette of the finely ground sample was heated under a small gas-fired radiation furnace of special design. The unmelted material served as a crucible for the liquid which formed, and the crucible temperatures were measured optically. It is possible to reach a temperature of 1700°C. The liquid may be cast and the results are shown to be reproducible.

Refractories Division Luncheon and Business Meeting

Royal York Hotel: Roof Garden

Wednesday Afternoon, April 10, 1940: 12:15 P.M.–2:15 P.M.

REFRACTORIES DIVISION PROGRAM (continued)

Royal York Hotel: Roof Garden

Wednesday Afternoon, April 10, 1940: 2:30 P.M.–5:00 P.M.

2:30–2:45 P.M.

19. A New Slag Testing Furnace

By Charles J. McMullen: The Carborundum Company, Niagara Falls, N. Y.

A compact furnace is described for testing the action of slag on a section of a standard nine-inch brick up to temperatures as high as 1600°C. Slag, in the form of $^1/_2$-inch diameter rods, is fed automatically so as to melt and drip directly on the test brick. After running down the face of the brick, the slag is caught in sand on the furnace bottom. On completion of the test, the test piece, spent slag, and sand are easily removed, leaving the furnace clean. The controllable conditions in this furnace are the degree and uniformity of temperature, atmosphere, slag composition, rate of slag application, and slag drainage from the sample.

3:00–3:15 P.M.

20. The Penn State Laboratory Course in Refractories

By Nelson W. Taylor: Department of Ceramics, Pennsylvania State College, State College, Pa.

Instruction in Refractories at Penn State is given in 30 lectures and 45 to 50 hours of laboratory work. Ten experiments have been designed to show the principles underlying the behavior of refractory materials as related to physical texture and chemical properties. These experiments will be discussed. A separate course, Ceramic Petrography, dealing in part with refractory materials, is given simultaneously so that the student is made familiar with both the macro- and micro- characteristics of refractories under a variety of conditions.

3:30–4:00 P.M.

21. Method of Analyzing Chrome Ores and Refractory Products Containing Chrome Ore

By A. J. Boyle: Basic Dolomite, Incorporated, Maple Grove, Ohio

For a complete determination of the essentials in chrome ore, a combination of silica and iron, or nickel and iron crucibles, is employed. A direct method for MgO in the presence of R_2O_3 and chromate chromium is introduced. Perchloric acid is used only for the purpose of dehydrating silica.

STRUCTURAL CLAY PRODUCTS DIVISION PROGRAM

Chairman: C. R. Austin, Battelle Memorial Institute, Columbus, Ohio
Secretary: J. H. Isenhour, Isenhour Brick & Tile Company, Incorporated, Salisbury, N. C.

Program Committee

H. R. Straight, Chairman, Straight Engineering Company, Adel, Iowa
H. Z. Schofield, Engineering Experiment Station, Ohio State Univ., Columbus, Ohio
L. R. Whitaker, Richland Shale Products Company, Richtex, S. C.

Royal York Hotel: Private Dining Room No. 8

Tuesday Forenoon, April 9, 1940: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

1. Clay Preparation

By L. R. Whitaker: Richland Shale Products Company, Richtex, S. C.

The author discusses (1) the storage of clays, giving in detail the types of elevators, conveyers, cable hoist, and overhead crane used; (2) grinding, in which a comparison is made of the use of dry pans, rolls, hammer mills, and granulators; (3) screening from pans, rolls, and hammer mills; and (4) flow sheets to show the economical operation of the plant.

A study is presented of clay preparation, given in practical terms. The author attempts to reach some general conclusions as to the best method of preparing several types of clays and shales in the best manner with the lowest cost. Emphasis is placed on the grinding and screening of clays and shales with a high water content.

10:00–10:45 A.M.

2. Method of Measurement of the Cumulative Power Exerted in Plasticizing and Extruding a Stiff-Mud Column

By H. R. Straight: Straight Engineering Company, Adel, Iowa

A simple direct method is presented for measuring the power exerted from temperature measurements of clays and the conversion of the readings into power equivalent, as indicated by temperature rise during processing. This method is a means of saving power and of improving a body of clay through internal lubrication of the plastic clay.

10:45 A.M.–12:00 M.

3. Open Forum on "Improved Structure Possible Through Chemical Treatment of Plastic Clays"

Led by L. R. Whitaker: Richland Shale Products Company, Richtex, S. C.

Brick and tile plants are rapidly adopting the chemical treatment of clays, borrowing this idea from the whiteware and other producers of fine ceramic ware. The discussion is to include chemical additions that help in the grinding, tempering, forming, drying, firing, and improved color of clayware. The processing treatment, including the amount of chemicals added, costs, and the means of determining the type of chemical to suit the particular clay, is outlined.

Tuesday Afternoon, April 9, 1940: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

4. Application of Nickel Alloys to Reduce the Metal Wear Problem in the Ceramic Industry

By J. S. Vanick: Development and Research Division, International Nickel Corporation, New York, N. Y.

A summary of the steels and cast irons which possess special merit as wear-resisting materials is presented. The investigation of these materials in laboratory studies for physical properties and wear resistance and development to their ultimate destination as materials suitable for abrasion and wear resistance in the ceramic industry are described. The specifications throughout are considered from the standpoint of economy in purchase and service.

2:30–3:00 P.M.

5. Hard Surfacing Clayworking Machinery Parts for Low Cost in Improvement of Wear Resistance

By M. L. Eder: Coast Metals, Incorporated, Canton, Ohio

The writer presents an account of the use, application, and results of applying to machinery parts a special high wear-resisting metal on such surfaces as require concentrated wear. Data are presented, showing the cost of application, the amounts best used for efficiency, and the application by means of acetylene and the electric arc.

3:00–3:30 P.M.

6. Auger Problems and Their Cure

By F. S. Windolph: Chambers Brothers Company, Philadelphia, Pa.

The various methods followed in auger design and use to give a uniform flow of clay discharged from an auger are presented.

3:30–4:30 P.M.

7. Open Forum on "Die Problems and Their Cure"

Led by Wayne E. Barrett: Cleveland Builders Supply Company, Cleveland, Ohio

Note: All members who have specific die problems are requested to bring a dried unit to this session for inspection and discussion.

4:30–5:00 P.M.

8. Open Forum on "Wear-Resisting Machinery Parts"

Led by H. R. Straight: Straight Engineering Company, Adel, Iowa

STRUCTURAL CLAY PRODUCTS DIVISION

Royal York Hotel: Private Dining Room No. 8

Wednesday Forenoon, April 10, 1940: 9:30 A.M.–12:00 M.

9:30–9:50 A.M.

9. Correlation Between Laboratory Tests and Resistance of Building Brick to Freezing

By H. G. Schurecht: New York State Ceramic Experiment Station, Alfred, N. Y.

The resistance of building brick to freezing was compared with their absorption, saturation coefficient, rate of absorption, rate of drying, and their tendency to become saturated during outdoor storage.

9:50–10:10 A.M.

10. Improving the Fire Resistance of Clay Products

By Harry D. Foster: Engineering Experiment Station, Ohio State University, Columbus, Ohio

By fire resistance is meant the ability of assembled units of the material to withstand destruction and thereby prevent the spread of fire. Methods of determining fire resistance are described, and various methods of increasing this fire resistance are then described and discussed.

10:10–10:40 A.M.

11. Manufacture of Lightweight Products

By Harry D. Foster: Engineering Experiment Station, Ohio State University, Columbus, Ohio

In this paper, the term "lightweight" refers to those construction materials which have a density of from 30 to 60% of that obtained when the customary method of working up the raw materials is used. The various processes which have been developed to obtain levity have been grouped as follows: (*a*) the use of hollow extruded units; (*b*) the incorporation of combustible materials; (*c*) the incorporation of materials that may be removed by sublimation, solution, etc.; (*d*) the incorporation of natural or synthetic lightweight materials; (*e*) the formation of air or gas cells during the firing; and (*f*) the formation of air or gas cells prior to firing. These processes are described briefly.

10:40–11:10 A.M.

12. Effect of Repeated Wetting and Drying on Properties of Fired Clay

By W. R. Morgan: Department of Ceramics, Rutgers University, New Brunswick, N. J.

Clay specimens, fired to different stages of vitrification, were subjected to a maximum of 200 cycles of wetting and drying at a constant temperature of 100°F. to determine the effect of moisture expansion alone in the absence of thermal shock. Experimental data are presented which show the effect of the treatment on modulus of rupture, modulus of elasticity, expansion, and permanent gain in weight.

11:10 A.M.–12:00 M.

13. Open Discussion on "Mortar Mix Manufacture and Use"

Led by H. R. Straight: Straight Engineering Company, Adel, Iowa

Wednesday Afternoon, April 10, 1940

Private Dining Room No. 8: 2:00 P.M.–5:00 P.M.

2:00–2:15 P.M.

14. Stoker Firing of Kilns

By J. E. Martin: Link-Belt Company, 2410 West 18th St., Chicago, Ill.

The author discusses (1) the benefits that may be expected from the application of the kiln stoker; (2) a description and illustration of the product; (3) the method of application; and (4) points to be considered in applying this equipment to each particular plant.

2:15–2:30 P.M.

15. Use of the Tunnel Kiln for Brick and Tile

By J. H. Isenhour: Isenhour Brick & Tile Company, Incorporated, Salisbury, N. C.

The following points are discussed in the process of firing brick and tile in a tunnel kiln: (1) compactness of the installation, (2) adaptability and versatility of the tunnel kiln for firing brick and tile, (3) the process of flashing and obtaining clear colors, and (4) the economy of operation as compared with round kilns.

2:30–3:00 P.M.

16. Résumé of Structural Clay Products Research in 1939

By Harry C. Plummer: Structural Clay Products Institute, Washington, D. C.; and Frederick Heath, Jr.: Colonial Clays, Incorporated, Worcester, Mass.

The authors discuss structural clay products research in 1939, using as a background their paper "Inventory-Taking of Structural Clay Products Research Program," *Bull. Amer. Ceram. Soc.*, **18** [12] 566–67 (1939).

3:00–3:30 P.M.

17. An Internal Recirculation Car-Tunnel Waste-Heat Drier

By E. W. Knapp: 639 Main St., E., Hamilton, Ontario, Canada

A complicated drying problem was created by firing three-foot lengths of small sizes of sewer pipe and various lengths and sizes of telephone conduits in two large tunnel kilns. The usual slatted floor driers were found to be impractical because of their slowness and the resulting warpage. This problem was solved by erecting a car-tunnel drier above the two tunnel kilns to utilize every possible source of heat. The design, construction, operation, and results are described.

3:30–4:00 P.M.

18. Setting of Face Brick in Downdraft Kilns and Its Relation to Heat Distribution

By F. E. Lobaugh: Department of Ceramic Engineering, New York State College of Ceramics, Alfred, N. Y.

Various methods of setting face brick in downdraft kilns, burning coal under induced draft, are discussed. Tight setting in the bottom courses gave a more uniform firing throughout the kiln.

4:00–4:30 P.M.

19. Principles of Furnace Design, Floor Openings, Setting, and Draft to Effect Fuel Economy

By L. R. Whitaker: Richland Shale Products Company, Richtex, S. C.

4:30–5:00 P.M.

Business Meeting

Adoption of Rules for the Division.

WHITE WARES DIVISION PROGRAM

Chairman: Karl Schwartzwalder, A C Spark Plug Company, Flint, Mich.
Secretary: Harry Thiemecke, Homer Laughlin China Company, Newell, W. Va.

Program Committee

Ralston Russell, Jr., Chairman, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
F. C. Henderson, Hall China Company, East Liverpool, Ohio
J. R. Kauffman, Department of Ceramics, Rutgers University, New Brunswick, N. J.

Royal York Hotel: Private Dining Rooms Nos. 1–5

Tuesday Forenoon, April 9, 1940: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

1. Factors Affecting Plaster Mold Life

By J. A. F. Wendt: U. S. Gypsum Company, Chicago, Ill.

10:00–10:15 A.M.

2. Decalcomania: Proposed Development

By Arthur S. Watts: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

The greatest fault of overglaze decalcomania is the lack of resistance to solution and abrasion, which is due chiefly to the fluxes used for adherence to the glazed surfaces and for the development of brilliancy. With our increasing knowledge of silicate eutectics, these properties may be greatly improved. Various color fluxes are tested and several experimental fluxes with improved chemical resistance are reported. The possibilities of overglaze colors and decalcomania that mature at 1500° and 1750°F. are also discussed, and some data are furnished.

10:15–10:35 A.M.

3. Some Heats of Wetting Values of Unfired and Fired Clays

By C. W. Parmelee and V. D. Fréchette: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The heats of wetting of unfired and fired clay minerals were measured on samples of montmorillonite, illite, and kaolinite types of clays. Autoclaved and unautoclaved samples of fired clays were also studied. These data were obtained as a contribution to the knowledge of the well-known changes taking place in fired clayware after exposure to water vapor.

10:35–11:20 A.M.

4. Circular Rubber Tube Method of Conveying Ceramic Materials

By R. W. Burdett: Johns Conveyor Division, Osborn Manufacturing Company, Cleveland, Ohio

Dustless conveying with low power consumption, resistance to abrasion, complete conveying of batches, and elimination of contamination is described. The Johns conveyer is called "The Pipeline That Moves." Slides will be shown of the construction and typical layouts, illustrating the flexibility of the conveyer which travels in any desired direction or combination of directions and in planes without the necessity of discharging from one conveyer to another.

11:20–11:40 A.M.

5. A Study of the Consistency of Bristol Glaze Slips

By C. G. Harman and C. F. Schaefer: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

An investigation is presented of methods of testing glaze slips. Bristol glaze slips were used in which the water content, age, and kinds and amounts of raw clays were varied. The following tests were made: (1) surface tension of the slips by the maximum bubble-pressure method; (2) the quantity of slip retained by a standard plate after immersion when withdrawn from the slip at a standard velocity; (3) thickness of glaze on test tile; and (4) appearance of glazes after firing.

The experiments showed that the amount of slip clinging to the glass plate when it was withdrawn from the slip reservoir is directly influenced by those factors, such as water content, clay content, age, etc., which are commonly thought of as governing the working quality of the glaze. Surface tension is not directly related to the working properties of this type of glaze on raw bodies. The glazes on the fired pieces showed that there is a distinct coherence value which separates the good from the bad. A total of 110 pieces was fired, and fifty-two of these were glazed with slips having coherence values above 0.04 gm. per sq. cm. Only three of the fifty-two pieces were satisfactory. The remaining fifty-eight test pieces were glazed with slips having coherence below 0.04 gm. per sq. cm. Only nine of these were defective in any respect and these were near the 0.04 gm. per sq. cm. line.

11:40 A.M.–12:00 M.

6. Length Changes in Some Whiteware Clays and Bodies During Initial Heating to 1250°C.

By R. F. Geller: National Bureau of Standards, Washington, D. C.

Several primary and secondary kaolins and ball clays, typifying those used in the industry, were studied to determine the length changes which they undergo when initially heated. The effects of several factors, such as rate of heating and additions of feldspar, flint, and mica, on these length changes were observed. Similar observations were made on three whiteware bodies. The tests were made from room temperature to 1250°C.

WHITE WARES DIVISION PROGRAM (continued)

Joint Meeting: White Wares and Materials and Equipment Divisions

Royal York Hotel: Private Dining Rooms Nos. 1–5

Tuesday Afternoon, April 9, 1940: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

7. A Simple Method of Evaluating Size Distribution Data

By Paul S. Roller: Bureau of Mines, Eastern Experiment Station, College Park, Md.

It is desirable and important to be able to treat data on size distribution so as to obtain values that summarize and represent the effect of all sizes in the distribution. Constants that represent the properties of a material depending on size are (1) surface area per gram, (2) coefficient of uniformity, (3) coefficient of regression, and (4) number of particles per gram.

These constants are defined, and their physical significance is discussed. They are evaluated properly only by statistical method. It is shown, however, that a good approximation is obtained by constants determined from quartile values, that is, the size at 25, 50, and 75% by weight. The quartile values have to be corrected by a factor dependent on the quartile coefficient of uniformity to make them conform best to the statistical constants. The quartile method offers a practical and sound method of routine or preliminary evaluation of size data. Illustrations with respect to ceramic materials are given.

(Presented by permission of the Acting Director, Bureau of Mines, U. S. Department of the Interior.)

2:30–3:00 P.M.

8. The Rate of Decomposition of Kyanite at Various Temperatures

By Helen Blair Barlett: A C Spark Plug Company, Flint, Mich.

The rate at which kyanite of various grain sizes decomposes into mullite and glass in the range 1350° to 1600°C. is given. Kyanite from several sources is also discussed.

3:00–3:30 P.M.

9. New Considerations in the Determination of Size Distribution by Fractionating with Air

By Paul S. Roller: Bureau of Mines, Eastern Experiment Station, College Park, Md.

In obtaining analytical size fractions by means of air, the later rates of separation approach zero more slowly than one would expect. This is considered to be an effect of the parabolic velocity gradient in the settling tube. The effect does not exist during the major part of the run because the concentration of dust evens out the natural velocity gradient. A method of overcoming the persistence of separation toward the end has now been found. This is based on a simple law of fractionation similar to the law of radioactive decay which permits extrapolation of the residuals in a fraction to infinite time. The results are now independent of any arbitrariness of procedure or of size or shape of the apparatus, and the method is therefore an absolute one.

A time method has also been developed in which the fractions are secured after a predetermined time of running, generally up to 15 minutes, with automatic cut-off. The method is calibrated by the results obtained from the absolute method. It is rapid and convenient, and, as repeated tests have shown, it is surprisingly precise. Application to ceramic materials is described.

(Presented by permission of the Acting Director, Bureau of Mines, U. S. Department of the Interior.)

3:30–3:45 P.M.

10. Grain-Size Distribution of Ingredients versus Body Properties

By J. H. Koenig: The Hall China Company, East Liverpool, Ohio

Bodies of the same formula were prepared with the particle-size distribution of certain materials introduced as the variable. The properties tested included workability and castability, flexural strength, elasticity, thermal expansion, and thermal endurance. The Andreasen pipette method was used for grain-size measurements.

3:45–4:15 P.M.

11. Discussion on "Effects of Particle Size of a Potter's 'Flint' and a Feldspar in Whiteware" (published *Bur. Stand. Jour. Research*, **11** [3] 327-40 (1933); R.P. 594)

By R. F. Geller, D. N. Evans, and A. S. Creamer: National Bureau of Standards, Washington, D. C.

A discussion will be presented on work at the National Bureau of Standards.

4:15–5:00 P.M.

General Discussion

WHITE WARES DIVISION PROGRAM (continued)

Royal York Hotel: Private Dining Rooms Nos. 1–5

Wednesday Forenoon, April 10, 1940: 9:30 A. M.–12:00 M.

9:30–9:55 A.M.

12. Substitution of Nepheline Syenite for Feldspar in Vitrified Floor-Tile Bodies

By Paul S. Dear: Department of Ceramic Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

The physical properties of a series of white tile bodies containing feldspar as the glass-forming ingredient are compared with those of a similar body series in which the feldspar fraction is replaced weight for weight by nepheline syenite. The different bodies of each flux series cover a composition field over which the flux, clay, and flint contents are systematically varied. The results indicate that suitable floor-tile bodies can be obtained at lower temperatures when nepheline syenite is substituted directly for feldspar as the fluxing ingredient.

9:55–10:20 A.M.

13. Lepidolite-Feldspar Mixtures as Fluxes for Whiteware Bodies

By C. M. Lampman: New York State Ceramic Experiment Station, Alfred, N. Y.

A mixture of two parts of lepidolite and one part of feldspar increased the strength of whiteware bodies. This mixture also lowered the vitrification temperature and increased the translucency at low temperatures.

10:20–10:45 A.M.

14. Reflectance Measurements of Glazes

By J. A. Pask: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Measurements with a Hunter reflectometer were made on a lead-borosilicate glaze series. The effect of the varied compositions and thicknesses of the glazes on the reflectance is indicated by curves. Additions of tin oxide were made to one of the glazes. Reflectances were also obtained of some typical Bristol, porcelain, and raw lead glazes.

10:45–11:10 A.M.

15. Thermal Expansion of Silicate Fluxes in the Crystalline and Glassy State

By H. J. Orlowski and C. J. Koenig: Engineering Experiment Station, Ohio State University, Columbus, Ohio

A general investigation of the thermal expansion of various silicate fluxes in the crystalline (anisotropic) and glassy (isotropic) states. The fluxes considered are eight potash feldspars, two soda feldspars, and two nepheline syenites; and anorthosite, aplite, and lepidolite.

11:10–11:35 A.M.

16. The System K_2O–Al_2O_3–SiO_2

By J. F. Schairer and N. L. Bowen (presented by G. W. Morey): Geophysical Laboratory, Washington, D. C.

Phase equilibrium relations for the ternary system K_2O–Al_2O_3–SiO_2 are presented by means of two diagrams. The fields of stability of leucite, potash feldspar, kaliophilite, tridymite, cristobalite, corundum, mullite, potassium tetrasilicate, and potassium disilicate are delineated. The mutual melting relations are presented by means of a diagram with isotherms. Six binary and ten ternary invariant points within the ternary system were determined. About 400 different ternary compositions were studied to determine the relations presented.

11:35 A.M.–12:00 M.

17. Conditions Affecting the Fit Characteristics of Tile Glazes

By J. R. Kauffman and L. E. Kane: Department of Ceramics, Rutgers University, New Brunswick, N. J.

The results of an investigation are presented on the individual and combined effects of (1) thermal expansion of the glaze; (2) thermal expansion, moisture expansion, and strength of the body; (3) body and glaze reactions in firing; and (4) the effect of time, temperature, and pressure in autoclave treatments. The studies were made on known body and glaze compositions and on representative commercial glazed and bisque wall tile.

Wednesday Afternoon, April 10, 1940
2:00 P.M.–5:00 P.M.

Private Dining Rooms Nos. 1–5

2:00–2:25 P.M.

18. Influence of Reduction on Some Properties of Whiteware Bodies

By J. F. McMahon and C. M. Lampman: New York State Ceramic Experiment Station, Alfred, N. Y.

The effect of firing under reducing conditions was studied, and this method is shown to produce marked changes in the vitrification behavior and other properties of the ware.

2:25–2:50 P.M.

19. Problems Involved in Rapid Firing of Vitreous China Sanitary Ware

By A. O. Knecht: Universal Sanitary Manufacturing Company, Camden, N. J.

Two important factors must be considered when shortening the firing time of vitreous china sanitary ware, viz., dunting and warpage. Rapid cooling results in better glaze appearance and can be accomplished without detrimental effects to the glass phase and dunting of the ware. The preheating and vitrification zones, however, must be closely controlled to prevent warpage.

Data are given on the fuel consumption and the ware load, and a time-temperature curve is shown.

2:50–3:15 P.M.

20. Heat-Work Analysis

By Myril C. Shaw: Edward Orton, Jr., Ceramic Foundation, Columbus, Ohio

Heat work or the extent of heat treatment in any ceramic process can be definitely established and reproduced through the proper interpretation of pyrometric cone performance and a wise application of this information. Pyrometric cones, being mixtures of the more common ceramic raw materials, are subject to the many thermochemical laws and principles, and their reactions under the influence of heat are variable to a degree depending on the rate and extent of heat treatment. Charts illustrating the deformation characteristics of pyrometric cones at different rates of heating are discussed to show the effect of variable time-temperature relationships on the maturing characteristics of the average ceramic bodies.

3:15–3:40 P.M.

21. Design for a Laboratory Continuous Tunnel Kiln

By C. H. Commons, Jr., and E. E. Kunzman: Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

Details are given on the design, operation, and gas consumption of a laboratory continuous tunnel kiln. The results obtained in firing glazed ware in this kiln are compared with those in an intermittent kiln with the same formulation.

3:40–4:10 P.M.

22. Development of Superstructure for Firing Whiteware

By William S. Emley: New Castle Refractories Company, New Castle, Pa.

A discussion is given of superstructure, including the history of the introduction and development of design covering the various fields of application in the whiteware industry. Reference is made to sagger and tile-setter progress, and the results of the manufacturer's simulative service tests are given (illustrated).

4:10–5:00 P.M.

Business Session

WHITE WARES DIVISION PROGRAM (concluded)

Joint Meeting: White Wares and Materials and Equipment Divisions

Royal York Hotel: Private Dining Rooms Nos. 1–5

Thursday Forenoon, April 11, 1940: 9:00 A.M.–12:00 M.

Symposium on "Substitution of American for Imported Clays in Whiteware Bodies"

Presiding Chairmen: J. R. Beam and W. R. Malkin

9:00–9:15 A.M.

23. Introduction

By Arthur S. Watts: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

A brief survey is presented of the development of various whiteware bodies and of the discovery and utilization of primary and secondary kaolins and ball clays, both in Europe and in America, and of the introduction of English china clays and ball clays into the United States. Attempts to exploit American primary and secondary kaolins and ball clays, the difficulties and opposition encountered, and the early attempts to improve quality and uniformity of American clays are reviewed. The recent accomplishments in this direction, the essential differences between English and American kaolins and ball clays, an analysis of plasticity as a property of clays, and a possible explanation of the difference between theoretical and practical evaluations are outlined.

9:15–9:40 A.M.

24. Properties of American Kaolin and English China Clays

By T. A. Klinefelter: National Bureau of Standards, Washington, D. C.

9:40–10:00 A.M.

25. Ball Clays in Whiteware Bodies

By V. J. Roehm: Kentucky Clay Mining Company, Alliance, Ohio

10:00–10:15 A.M.

26. Study of Fractionated Whiteware Clays (Preliminary Study)

By F. H. Norton and A. L. Johnson: Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

The preliminary work is presented of an extensive research program on the castability of clays at the laboratories of the Massachusetts Institute of Technology. Fractions from four types of whiteware clay were prepared, all having the same distribution of particle size in a comparatively narrow range. These fractions were dialyzed and were treated to remove the organic matter. The physical properties obtained show that each fraction, regardless of its origin, is very like the others.

10:15–10:30 A.M.

27. All-American Sanitary Ware Body

By I. E. Sproat, C. C. Treischel, and E. W. Emrich: R. T. Vanderbilt Company, Incorporated, 230 Park Ave., New York, N. Y.

The development of a casting body for sanitary ware is based on the following ideas: (1) organic deflocculating agents are inherently better than inorganic deflocculants; (2) the use of at least three ball clays and two kaolins allows for better control of uniformity of physical properties of casting slip; and (3) the proper selection of domestic clays will give casting slips that cast as fast or faster than those made from imported clays.

Comparisons with commercial bodies are made for color, shrinkage, absorption, speed of casting, and rate of thickening.

10:30–10:45 A.M.

28. American Clays in Whiteware

By Hewitt Wilson and Ernest Wilson: Electrotechnical Laboratory, Bureau of Mines, Norris, Tenn.

Laboratory tests of table, art, and sanitary ware using American kaolins and ball clays are discussed.

10:45–11:00 A.M.

29. An All-American Body for Hotel China

By G. A. Loomis: Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Test data are presented on a hotel china body composed entirely of domestic minerals.

11:00 A.M.–12:00 M.

General Discussion

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OFFICIAL PERSONNEL OF DIVISIONS, 1939–1940

	Art	Enamel	Glass	Materials and Equipment	Refractories	Structural Clay Products	Terra Cotta	White Wares
Trustee	L. E. Barringer	H. G. Wolfram	D. E. Sharp	H. B. DuBois	C. E. Bales	A. F. Greaves-Walker	F. B. Ortman	E. H. Fritz
Chairman	J. P. Thorley	W. H. Pfeiffer	N. W. Taylor	William Malkin	S. F. Walton	C. R. Austin	H. E. Davis	K. Schwartzwalder
Vice-Chairman			W. R. Lester	B. T. Bonnot	J. B. Austin	H. Z. Schofield		
2nd Vice-Chairman	Theodore Lenchner		A. K. Lyle					
Secretary	C. C. Engle	D. G Bennett	S. R. Scholes	W. H. Emerson	Gilbert Soler	J. H. Isenhour	D. F. Albery	Harry Thiemecke
Society Nominations A.....	Carlton Atherton	B. A. Rice	W. M. Clark	R. B. Carothers	R. K. Hursh	E. W. Knapp	H. D. Callahan	F. P. Hall
Society Nominations B.....	H. E. Marley	G. H. McIntyre	J. T. Littleton	J. E. Eagle	L. J. Trostel	J. E. Rankin	R. L. Clare	J. R. Beam
Division Nominations	P. E. Thornton W. A. Weldon	W. N. Harrison	A. N. Finn U. E. Bowes					
Papers and Program	W. A. Weldon E. de F. Curtis	J. D. Tetrick	W. R. Lester A. K. Lyle	F. E. Finch R. G. O'Meara S. S. Cole	R. S. Bradley G. S. Diamond W. R. McLain E. B. Read	H. R. Straight H. Z. Schofield L. R. Whitaker	H. E. Davis D. F. Albery	R. Russell, Jr. F. C. Henderson J. R. Kauffman
Membership	K. E. Smith	E. C. Aydelott	J. T. Ogden	R. C. Meeker	C. A. Freeman	J. H. Stewart J. H. Grady	J. L. Carruthers	Hewitt Wilson
Standards	K. E. Smith	C. R. Amberg	G. W. Morey		S. M. Swain E. H. Van Schoick	H. C. Plummer		J. H. Koenig
Research	C. M. Harder	R. L. Fellows	W. Weyl	V. J. Roehm	D. W. Ross	R. B. Keplinger		J. R. Beam
Data	E. de F. Curtis	E. C. Dexheimer	A. E. Badger	F. A. Guignon	C. L. Thompson	H. G. Schurecht	E. E. Marbaker	H. C. Harrison
Rules	W. A. Weldon E. de F. Curtis	G. H. Spencer-Strong	A. N. Finn	J. E. Eagle	K. E. Buck	G. H. Duncombe, Jr.		A. M. Hossenlopp
Councillors	Myrtle M. French E. de F. Curtis	F. R. Porter G. H. Spencer-Strong	F. C. Flint E. W. Tillotson	V. V. Kelsey		T. W. Garve F. M. Butterworth		F. P. Hall
Exhibitions	Anna Lane Dixon	*Bibliography* J. E. Rosenberg	R. M. Curts					W. E. Palmer
Industrial Management	Theodore Lenchner				Furman South, Jr.			

CERAMIC HISTORY

GORDON C. KEITH

The April issue of *The Bulletin* containing the Program of the Forty-Second Annual Meeting is being dedicated to Gordon C. Keith, Secretary-Treasurer of the Canadian Ceramic Society. Mr. Keith is well known, but his activities have never been recorded in the publications of The Society.

Gordon Campbell Keith, the son of Ann Baxter and David Roberts Keith, was born at Smiths Falls, Ontario, Canada, October 5, 1879. He attended the public and high schools at Smiths Falls, and in 1907 he was graduated from Queen's University, Kingston, Ontario, in Mechanical and Civil Engineering with the degree of B.Sc.; he also completed a course in Geology and Mineralogy and was awarded one of the Engineering Society thesis prizes in his final year. He received the M.Sc. degree in 1911.

During his college course, Mr. Keith worked in the mechanical and cost departments of the Frost & Wood Co., Ltd., in Smiths Falls, and for the Canadian Locomotive Company, Ltd., Kingston, Ont. He also worked on gas-engine design during this period. Following his graduation in 1907, he worked as assistant to the superintendent of the Frost & Wood Co.

A chronological outline of Mr. Keith's activities follows.

1907

Became assistant editor of *Canadian Machinery*, for which paper he had written during his college course.

1908

Named editor of *Canadian Machinery* and *Power House* (now *Modern Power*).

1908–1910

Wrote many articles on various subjects for *Busy Man's Magazine* (now *MacLean's*).

1909

Wrote and published book on Setting the Values of Canadian-Made Engines.

Elected Life Member of the Stationary Engineers' Association.

1910

December 22: Read illustrated paper on "Modern Machine Tool Practice" at the Central Railway and Engineering Club, of which he was a member.

1911

Elected director of Canadian National Clay Products Association, now known as the Canadian Ceramic Society.

Appointed editor of *Canadian Manufacturer* and *The Canadian Clay-Worker;* continued in this position until December, 1925. Read paper before the International Union of Steam Engineers, "Directions to Follow in Case of Accidents to Engineers."

March. "Keeping Toronto Street Cars in Service," published in *Engineering Digest.*

1912

February. Read paper before Canadian National Clay Products Association, "Economical Production and Use of Steam in Clay Products Plants."

July. Wrote "Impressions of Western Canada" (illustrated) after tour of western Canada; published in several Ontario publications.

1913

April 13. Addressed Calgary, Alberta, Board of Trade; met W. G. Worcester for the first time.

1914

September 14: Elected director of Ontario Association for the Promotion of Technical Education.

September 17: Elected Secretary-Treasurer of the Canadian National Clay Products Association, of which he had been a director.

October 6: Elected director of the Panama-Pacific Clay Products Association in connection with the San Francisco Fair of 1915.

1914–1918

Represented Queen's University on committee of engineers from different Canadian universities to investigate patents and suggestions in connection with the war and recommended many useful ideas.

1915

Prepared list of essential positions in Canadian industries for the Government in connection with preparation for conscription; printed in book form.

January 28: Read illustrated paper on "Design and Manufacture of Roofing Tile, Clay Covering, and Other Clay Products" before Canadian National Clay Products Association.

February 24: Addressed Ontario Hardware Association at Toronto convention on "Build Now" slogan.

September 6: Addressed Ontario Electrical Contractors on "Trade Papers and Trade Associations."

1916

February 24: Addressed National Brick Manufacturers' Association on "The Tie That Binds."

1917

February 22: Addressed Ontario Builders' Exchange at London, Ont., on "Making Use of the Trade Paper."

April 9: Elected to executive committee of Technical and Manual Arts Section of the Ontario Educational Association.

1918

February 26: Addressed Western Clayworkers on "Schemes for Increasing Sales of Field Tile."

June 26: Addressed Canadian stationary engineers at London, Ont.

1919

May 26: Presented paper, "The Tile Situation," at Montreal convention of Canadian National Clay Products Association.

July 9: Addressed Canadian stationary engineers at Brantford, Ont.

Appointed one of a committee of four to interview Dean C. H. Mitchell of the University of Toronto regarding the establishment of a ceramic course.

1924

February: Elected Life Member of the National Brick Manufacturers' Association at Cincinnati, Ohio.

1925

February 2: Appointed one of four trustees (Ryland H. New, *Chairman;* William Burgess, Harold F. Dingledine, and Gordon C. Keith, *Secretary-Treasurer*) to collect funds for the establishment of a ceramic course at the University of Toronto. Required amount ($9000) raised and also funds for a scholarship in Ceramic Engineering ($500); ceramic course started in the fall of 1925.

April: Organized Canadian dinner at Columbus, Ohio, for the heads of colleges in the United States having ceramic courses.

July 10: Elected Complimentary Member of The American Ceramic Society.

1926

January: Wrote "Value of Canada's Clay Products" in *Industrial Canada.*

January 27: Organized the brick manufacturers to secure cooperation in the sale of brick.

January: Assisted in the organization of a short course in ceramics at the University of Toronto.

Organized own company and edited and published *Clay Products News & Ceramic Record* and *Manufacturing & Industrial Engineering.*

March 12: Elected secretary and treasurer of the Canadian Business Publishers Association, which position he still holds.

Acted with committee to take up the standard size of brick among manufacturers; visited every brick manufacturer in this district and visited Ottawa to secure recognition of standard by the Canadian Engineering Standards Association.

1927

Represented the publishers of Canada at the Diamond Jubilee of Canada celebration at Ottawa as the guest of the Canadian Government.

1929

May: Member of committee to arrange entertainment for British ceramists.

1930

January 2: Wrote "Clay Products Plants Had Favorable Year" in Industrial and Financial issue of *Mail & Empire.*

Secretary of committee to arrange entertainment of The American Ceramic Society.

1931

Member of committee, representing clay products manufacturers, to entertain Building Officials of America.

1932

February 22: Name of Canadian National Clay Products Association changed to Canadian Ceramic Society and joined by Canadian Porcelain Enamellers Association as the Enamel Division; on committee to arrange this union and elected Secretary-Treasurer of the Association under its new name.

1938

April 24: Paper on safety read before the Ceramic Division of the Industrial Accident Prevention Associations at Windsor, Ontario.

Member, Canadian Engineering Standards Association.

Wrote a series of articles on farm engineering for the *Family Herald & Weekly Star,* Montreal.

Organized fall meetings for the Canadian Ceramic Society; these have been well attended.

Mrs. Lillian Layng Keith, wife of Gordon C. Keith, received the degree of B.A. from McMaster University in 1904, with honors in Moderns, History, and English. In 1905, she obtained a specialist's teaching certificate. In 1907, she secured her M.A. degree in History and English in the secondary schools. Mrs. Keith is a member of the Women's Advisory Board of McMaster University, a member of the Women's University Club, and is well known in Toronto as a musician and public speaker.

Mr. Keith's daughter, Lillian Constance, is a graduate of Moulton College in Toronto and honor graduate in English and History from McMaster University, with the B.A. degree. She is a member of the Canadian Women's Press Association and the Strathcona Bowling, Tennis, and Badminton clubs, and is by profession a writer.

Mr. Keith's son, Gordon Layng Keith, was graduated in chemical engineering in 1935 from the University of Toronto, where he received the degree of Bachelor of Applied Science. He is manager of Nuodex Products of Canada, Ltd., Toronto, and is a member of the Strathcona Tennis, Bowling, Badminton, and Skiing clubs.

THE INSTITUTE OF CERAMIC ENGINEERS

Executive Committee

President: J. L. CARRUTHERS, Ohio State Univ., Columbus, Ohio.
Vice-President: H. G. WOLFRAM, Porcelain Enamel & Mfg. Co., Baltimore, Md.
Secretary: S. J. MCDOWELL, General Ceramics Co., Keasbey, N. J.
Past-President: A. F. GREAVES-WALKER, Univ. of North Carolina, Raleigh, N. C.
Trustee Representative: R. E. BIRCH, Harbison-Walker Refractories Co., Pittsburgh, Pa.

Annual Meeting

The Institute will hold two meetings at Toronto at times announced elsewhere in this issue of *The Bulletin* (see Program Schedule, p. 121). It is hoped that a high proportion of the membership will be present.

Many will feel that the most important item of business will be the "Examination Plan" on which the Membership and Examinations Committee has been working. The Rules provide that applicants for Member grade must either have passed an Institute examination or must hold a state or national license as a professional engineer. In the present absence of an examination plan, it has been necessary to classify some qualified ceramic engineers temporarily as Associate Members, even though they may be eligible for the Member grade. The plan to be proposed at Toronto is intended to eliminate this bottleneck. This subject vitally affects the Institute, inasmuch as a completely integrated and workable membership plan is essential both to its growth and to the maintenance of suitable standards.

Officers Nominated

The Institute has already balloted by mail on officers for the coming year. The results of the balloting will be known so that the new officers may be installed at the Annual Meeting. The nominees submitted by the Committee on Nominations are as follows:

For President: Harold G. Wolfram, B.Sc. in Cer.E., University of Illinois, 1919; now vice-president, Porcelain Enamel & Manufacturing Co., Baltimore, Maryland. Before going to Baltimore in 1926, Mr. Wolfram served as ceramic engineer with the Bureau of Standards. He has long been active in the Enamel Division and now represents that Division as Trustee.

For Vice-President: Edwin H. Fritz, B.Cer.E., Ceramic Engineer, Ohio State University; now manager, Derry Works (electrical porcelain) of Westinghouse Electric & Manufacturing Company. He was engineer with the American Blower Company in 1917, but is best known for his research and production work in electrical porcelain with Westinghouse. He has served The Society in many capacities, having been Chairman of the White Wares Division and is now representing that Division as Trustee.

James T. Robson, B.Chem.E. 1919; M.S. 1920; Ph.D. 1923; Ceramic Engineer 1937, Ohio State University; now with Allied Engineering Co., Cleveland, Ohio. Dr. Robson was instructor in ceramic engineering at Ohio State from 1919–1925. He directed the laboratories of the Harrop Ceramic Service Company from 1925 to 1933 and since 1935 has held his present position directing the activities of the Allied Engineering Co. (Ferro Enamel Co.).

For Secretary: Hobart M. Kraner, B.Cer.E. 1921; M.S. 1922; Ceramic Engineer 1938, Ohio State University; now research engineer, Bethlehem Steel Co., Bethlehem, Pa. Mr. Kraner's varied experience has included positions with the Bureau of Mines 1922–1923; A C Spark Plug Co. 1923–1924; Westinghouse Electric & Manufacturing Co., in research and later as superintendent of the Derry Porcelain Works, 1930–1932; and Corhart Refractories Co., 1932–1935, as research engineer. Mr. Kraner has been a frequent contributor to technical and scientific journals. He has served The Society as Chairman of the White Wares and Refractories Divisions and as representative to the National Research Council.

Robert Twells, B.S. in Cer.E., University of Illinois, 1920; now manager, Spark Plug Division, Electric Auto-Lite Company, Toledo, Ohio. His industrial experience includes research work with the General Electric Co. and the Champion Spark Plug Co. His present connection dates from 1935. He has been active in The Society and is well known for his research and production work on mullite refractories and on electrical porcelain and glazes.

For Nominating Committee A: Hewitt Wilson, Electrotechnical Lab., Bureau of Mines, Norris, Tenn., and George R. Sylvester, Allied Engineering Co., Cleveland, Ohio.

For Nominating Committee B: L. C. Hewitt, Lacledé-Christy Clay Products Co., St. Louis, Mo., and J. S. Gregorius, Pittsburgh Plate Glass Co., Creighton, Pa.

Rules Changes

A number of Amendments to the Rules, circulated to the membership on February 7, will be voted on at Toronto. Their substance is as follows:

(1) To create an office of Secretary-Treasurer. Originally there was a Secretary, but no provision has existed for an officer to handle duties connected with finances.

(2) To provide for means of suspending members for failure to pay assessments authorized by the Institute.

(3) To clarify certain sections dealing with membership qualifications, and in some cases to modify the membership requirements.

Finances

The two-dollar assessment of all members, which was ample for all 1939 expenses, left a small surplus. The budget for 1940, which follows, indicates that a similar assessment for this year (232 members at $2.00 each) will cover expenses and allow for a measurable broadening of activities.

1940 BUDGET

Membership in American Engineering Council	$100.00
Membership in Society for Promotion of Engineering Education	15.00
Traveling expenses of representative to engineering meetings*	160.00
Printing	75.00
Postage	50.00
Stenographic service	25.00
Contingent fund	25.00
	$450.00

* Annual meetings of American Engineering Council, American Institute of Mining & Metallurgical Engineers, and National Council of State Boards of Engineering Examiners.

This budget has been approved by the Executive Committee of the Institute and by the Trustees of The American Ceramic Society.

Membership in
The American Ceramic Society
FOR CONTINUING EDUCATION IN CERAMICS

ROSTER OF CORPORATION MEMBERS

Abbé Engineering Co., New York, N. Y.
Abingdon Sanitary Mfg. Co., Abingdon, Ill.
A C Spark Plug Co., Flint, Mich.
Akron Porcelain Co., Akron, Ohio
American Gas Assn., New York, N. Y.
American Lava Corp., Chattanooga, Tenn.
American Nepheline Corp., Rochester, N. Y.
American Potash & Chemical Corp., New York, N. Y.
American Refractories Institute, Pittsburgh, Pa.
American Rolling Mill Co., Middletown, Ohio
American Stove Company, St. Louis, Mo.
Amsler-Morton Co., Pittsburgh, Pa.
Anchor Hocking Glass Corp., Lancaster, Ohio
Arketex Ceramic Corp., Brazil, Ind.
Armstrong Cork Co., Lancaster, Pa.
Atlantic Terra Cotta Co., Perth Amboy, N. J.

Babcock & Wilcox Co., New York, N. Y.
Ball Brothers Co., Muncie, Ind.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Bausch & Lomb Optical Co., Rochester, N. Y.
Belden Brick Co., Canton, Ohio
Binghamton Brick Co., Inc., Binghamton, N. Y.
Blue Ridge Glass Corp., Kingsport, Tenn.
Blythe Colour Works, Ltd., Cresswell, Stoke-on-Trent, England
Bonnot Company, Canton, Ohio
Braun Corp., Los Angeles, Calif.
Brockway Glass Company, Inc., Brockway, Pa.
Buck Glass Company, Baltimore, Md.
Buffalo Pottery, Buffalo, N. Y.

Camp Brothers Company, Mogadore, Ohio
Canadian General Electric Co., Ltd., Peterborough, Ontario, Canada
Canton Stamping & Enameling Co., Canton, Ohio
Carborundum Company, Niagara Falls, N. Y.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Carr-Lowrey Glass Co., Baltimore, Md.
Celo Mines, Inc., Burnsville, N. C.
Central Silica Company, Zanesville, Ohio
Ceramic Color & Chemical Mfg. Co., New Brighton, Pa.
Certain-Teed Products Corp., Buffalo, N. Y.
Champion Spark Plug Co., Detroit, Mich.
Chattanooga Glass Co., Chattanooga, Tenn.
Chicago Hardware Foundry Co., North Chicago, Ill.
Chicago Pottery Co., Chicago, Ill.
Chicago Vitreous Enamel Product Co., Cicero, Ill.
Clark, N., & Sons, San Francisco, Calif.
Colonial Insulator Co., Akron, Ohio
Commercial Decal Products, Inc., East Liverpool, Ohio
Coors Porcelain Company, Golden, Colo.
Corhart Refractories Co., Inc., Louisville, Ky.
Corning Glass Works, Corning, N. Y.
Crane Enamelware Company, Chattanooga, Tenn.
Cronin China Co., Minerva, Ohio
Crooksville China Co., Crooksville, Ohio
Crossley Machine Co., Trenton, N. J.
Crossman Company, South Amboy, N. J.
Crown Potteries Co., Evansville, Ind.

DeVilbiss Co., Toledo, Ohio
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Drakenfeld, B. F., & Co., New York, N. Y.
Du Pont de Nemours, E. I., & Co., R. & H. Chemicals Dept., Wilmington, Del.

Edgar Plastic Kaolin Co., Metuchen, N. J.
Electro Refractories & Alloys Corp., Buffalo, N. Y.
Empire Sheet & Tin Plate Co., Mansfield, Ohio
Engelhard, Charles, Inc., Newark, N. J.
English China Clays Sales Corp., New York, N. Y.
Eureka Flint & Spar Co., Trenton, N. J.
Exolon Company, Blasdell, N. Y.

Fairfacts Company, Inc., Trenton, N. J.
Federal Seaboard Terra Cotta Corp., Perth Amboy, N. J.
Ferro Enamel Corp., Cleveland, Ohio
Findlay Clay Products Co., Washington, Pa.
Foote Mineral Co., Philadelphia, Pa.
Fords Porcelain Works, Perth Amboy, N. J.
Fostoria Glass Co., Moundsville, W. Va.
Frazier-Simplex, Inc., Washington, Pa.

Garco Products, Inc., Butler, Pa.
Gaynor Glass Works, Salem, N. J.
General Ceramics Co., New York, N. Y.
George, W. S., Pottery Co., East Palestine, Ohio
"Giesche" Fabryka Porcelany Sp. Akc., Katowice-Bogucice, Poland
Gillinder Brothers, Inc., Port Jervis, N. Y.
Gladding, McBean, & Co., Lincoln, Placer County, Calif.
Gleason-Tiebout Glass Co., Maspeth, N. Y.
Great Lakes Foundry Sand Co., Detroit, Mich.
Great Lakes Steel Corp., Detroit, Mich.
Green, A. P., Fire Brick Co., Mexico, Mo.

Haeger Potteries, Inc., Dundee, Ill.
Hall China Company, East Liverpool, Ohio
Hancock Brick & Tile Co., Findlay, Ohio
Hanley Company, Summerville, Pa.
Hanovia Chemical & Mfg. Co., Newark, N. J.
Hardinge Company, Inc., York, Pa.
Harshaw Chemical Co., Cleveland, Ohio
Hartford-Empire Co., Hartford, Conn.
Haws Refractories Company, Johnstown, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Hommel, O., Co., Pittsburgh, Pa.
Houze, L. J., Convex Glass Co., Point Marion, Pa.
Hygrade Sylvania Corp., Emporium, Pa.

Illinois Clay Products Co., Joliet, Ill.
Industrial Ceramic Products, Inc., Columbus, Ohio
Ingram-Richardson Mfg. Company of Indiana, Inc., Frankfort, Ind.
International Clay Machinery Co., Dayton, Ohio
International Smelting & Refining Co., Akron, Ohio
Irish Glass Bottle Co., Ltd., Dublin, Ireland
Ironton Fire Brick Co., Columbia, S. C.
Isolantite, Incorporated, Belleville, N. J.
Iyo Toki Kaisha, Ltd., Kobe, Japan

Jova Brick Works, Roseton, N. Y.

Kaolin, Incorporated, Spruce Pine, N. C.
Kentucky Clay Mining Co., Mayfield, Ky.
Kentucky-Tennessee Clay Co., Mayfield, Ky.
Knowles, Edwin M., China Co., Newell, W. Va.
Kohler Company, Kohler, Wis.
Koppers Company, Pittsburgh, Pa.
Kraftile Company, Niles, Calif.

Laclede-Christy Clay Products Co., St. Louis, Mo.
Lancaster Iron Works, Lancaster, Pa.
Lapp Insulator Co., Inc., Le Roy, N. Y.
Laughlin, Homer, China Co., Newell, W. Va.
Lava Crucible Co. of Pittsburgh, Pittsburgh, Pa.
Lee Clay Products Company, Clearfield, Ky.
Libbey Glass Company, Toledo, Ohio
Libbey-Owens-Ford Glass Co., Toledo, Ohio
Liberty Glass Co., Sapulpa, Okla.
Lindemann, A. J., & Hoverson Co., Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
London Brick Co., Ltd., London, England
Louthan Manufacturing Co., East Liverpool, Ohio
Lynch Corporation, Anderson, Ind.
Lynch, A. J., & Co., Los Angeles, Calif.

Mansfield Sanitary Pottery, Inc., Perrysville, Ohio
Mapleton Clay Products Company, Canton, Ohio
Maryland Glass Corp., Baltimore, Md.
Mason City Brick & Tile Co., Mason City, Iowa
Maxson, Elwyn L., Los Angeles, Calif.
McHose, L. H., Inc., Perth Amboy, N. J.
McKee, Arthur G., & Co., Cleveland, Ohio
Metal & Thermit Corp., New York, N. Y.
Metro Glass Bottle Co., Jersey City, N. J.
Mississippi Glass Co., New York, N. Y.
Mitchell Clay Mfg. Co., St. Louis, Mo.
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Moore & Munger, New York, N. Y.
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Mount Clemens Pottery Co., Mount Clemens, Mich.

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National Industrial Sand Assn., Washington, D. C.
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National Lime and Stone Co., Findlay, Ohio
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New Castle Refractories Co., New Castle, Pa.
New Jersey Porcelain Co., Trenton, N. J.
New Jersey Pulverizing Co., New York, N. Y.
Nippon Gaishi Kabushiki Kaisha, Nagoya, Japan
Nippon Toki Kaisha, Ltd., Nagoya, Japan
North American Refractories Co., Cleveland, Ohio
North Carolina Feldspar Corp., Erwin, Tenn.
Norton Company, Worcester, Mass.

Ohio Insulator Company Div., Ohio Brass Co., Barberton, Ohio
Old Hickory Clay Co., Paducah, Ky.
Olean Tile Co., Olean, N. Y.
Onondaga Pottery Co., Syracuse, N. Y.
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Orton, Edward, Jr., Ceramic Foundation, Columbus, Ohio
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Owens-Illinois Pacific Coast Co., San Francisco, Calif.

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Pacific Tile & Porcelain Co., Los Angeles, Calif.
Paper Makers Importing Co., Inc., Easton, Pa.
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Pfaudler Company, Rochester, N. Y.
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Porcelain Enamel & Mfg. Co., Baltimore, Md.
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Union Electrical Porcelain Works, Inc., Trenton, N. J.
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Vesuvius Crucible Co., Swissvale, Pa.
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Wallace China Co., Ltd., Huntington Park, Calif.
Waltham Grinding Wheel Co., Waltham, Mass.
Washington Porcelain Co., Washington, N. J.
Wayne Laboratories, Waynesboro, Pa.
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Thanks to Trade Publications

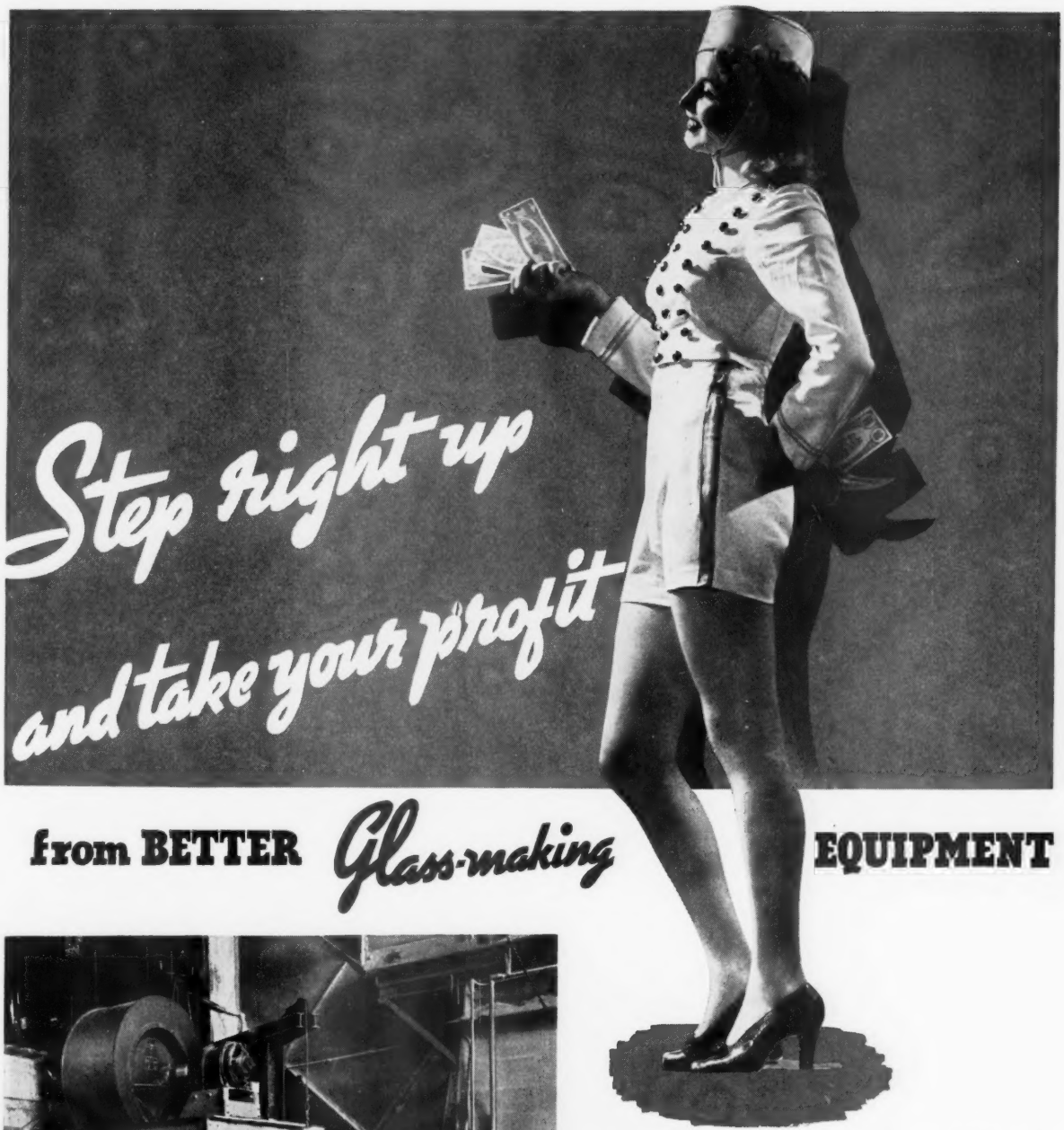
for their fine cooperation and publicity, which has helped to make The Society's Forty-Second Annual Meeting one of our best.

Sincerely,

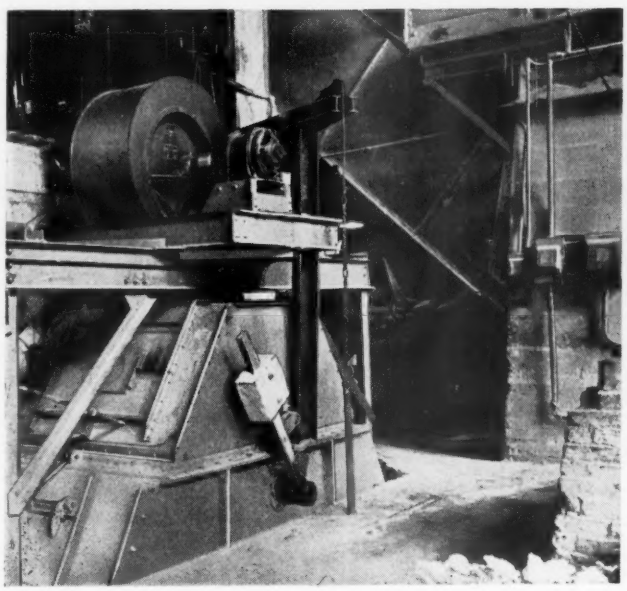
Ross C Purdy

General Secretary

The American Ceramic Society



from BETTER *Glass-making* **EQUIPMENT**



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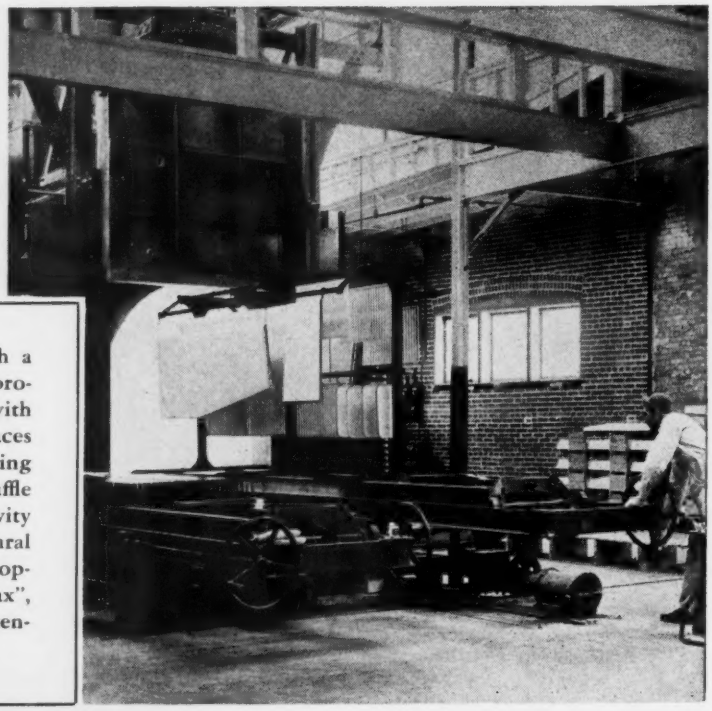
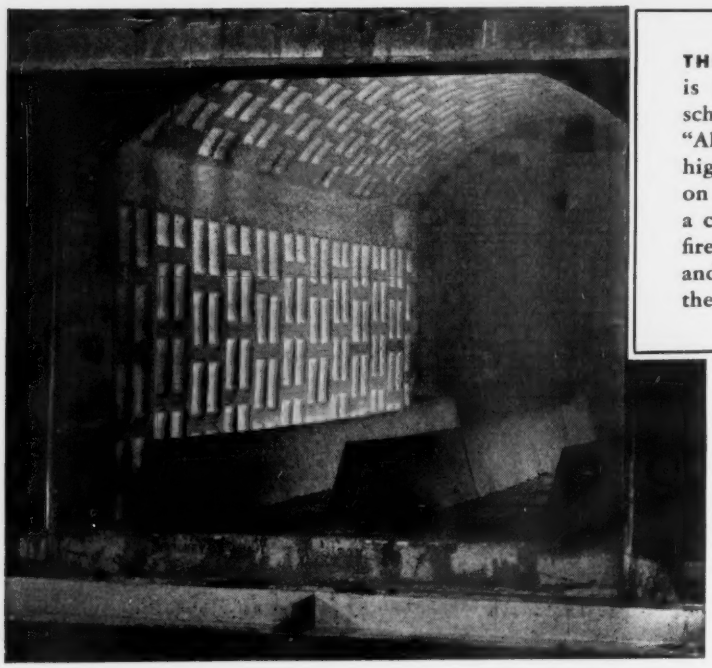


THE FIRST FURNACE is equipped with a "Carbofrax" muffle and is used for the production of refrigerator parts. Here, with loads having large areas of enamel surfaces and contours difficult to maintain at fusing temperatures, it is imperative that a muffle with the highest possible heat conductivity be used . . . so "Carbofrax" was the natural choice. And, because of the new developments in the manufacture of "Carbofrax", a long lived installation with low maintenance and replacement costs is assured.



THE SECOND FURNACE, on cast iron work, is naturally operated on much slower schedules and at lower temperatures. An "Alfrax" muffle is used because extremely high heat conductivity is not so important on such schedules. However, "Alfrax", with a conductivity three to four times that of fireclay, guarantees excellent fuel economy and, because of its chemical stability, assures the longest possible muffle life.

● With these two refractories to choose from, plus the technical information gathered in the twenty years Carborundum has been producing enamel furnace refractories, it is possible to obtain a muffle "tailor-made" for the operating conditions in your shop. (Some plants are now using combination muffles). Why not talk it over with our nearest representative?

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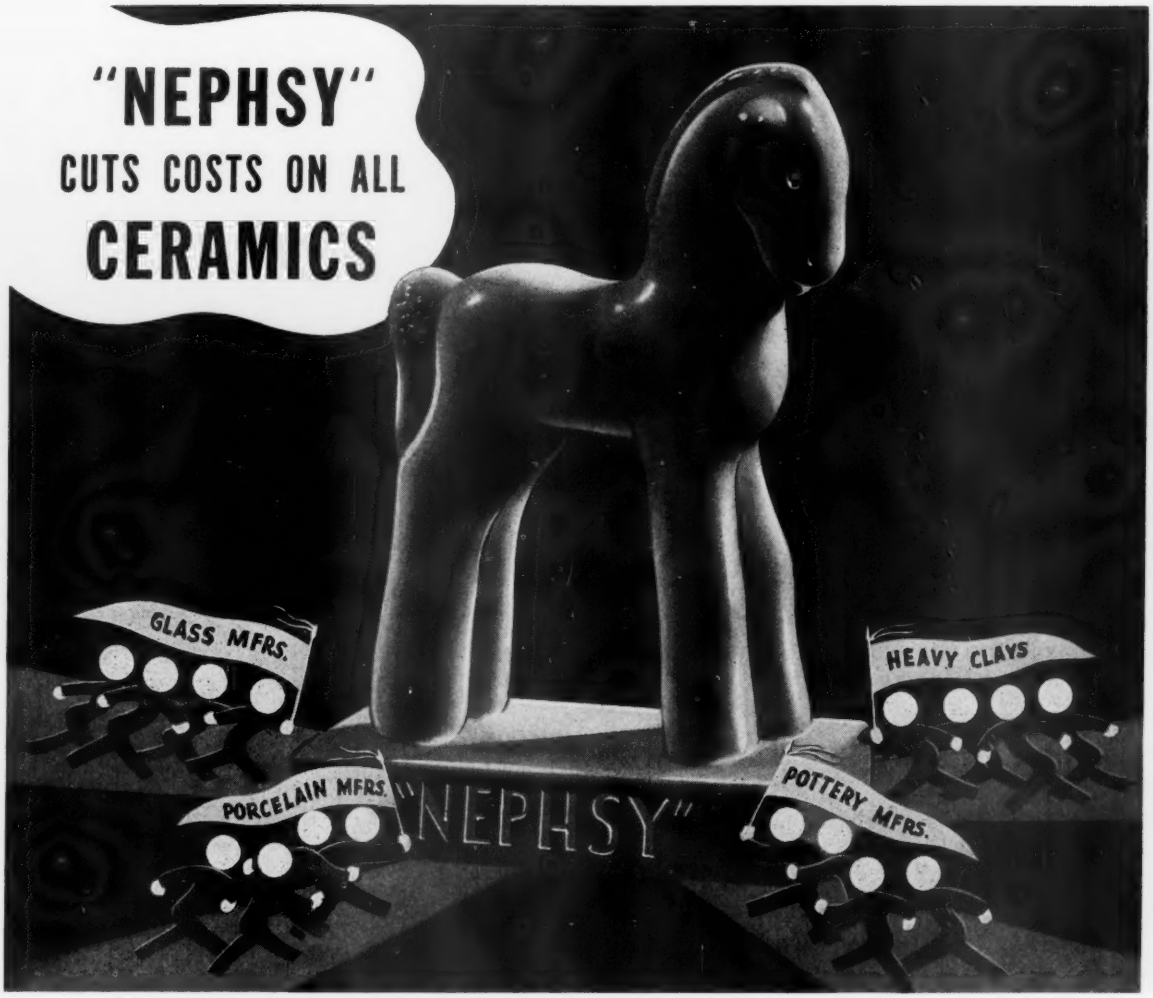
(Carborundum, Carbofrax, and Alfrax are registered trade-marks of and indicate manufacture by The Carborundum Company)



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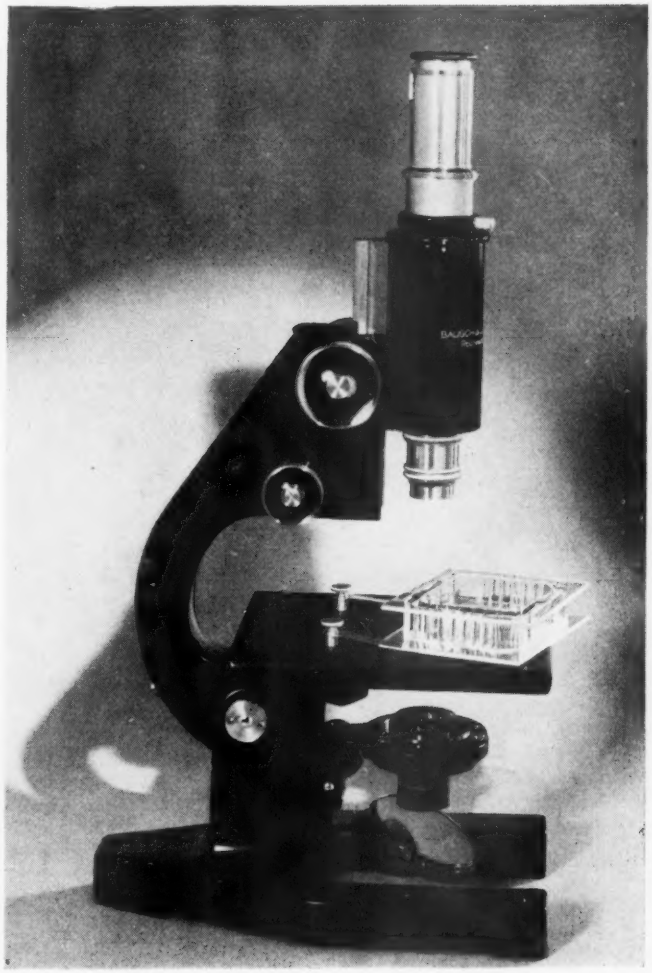

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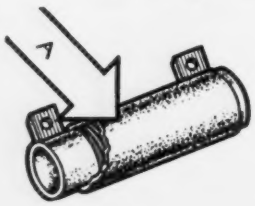

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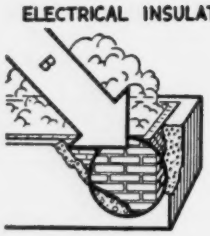

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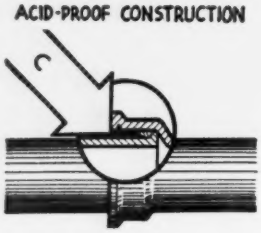
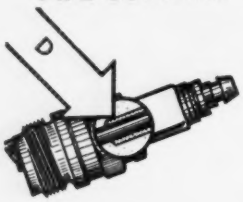


PIPE JOINTING



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Sauereisen Super Refractory Cement	No. 74	—
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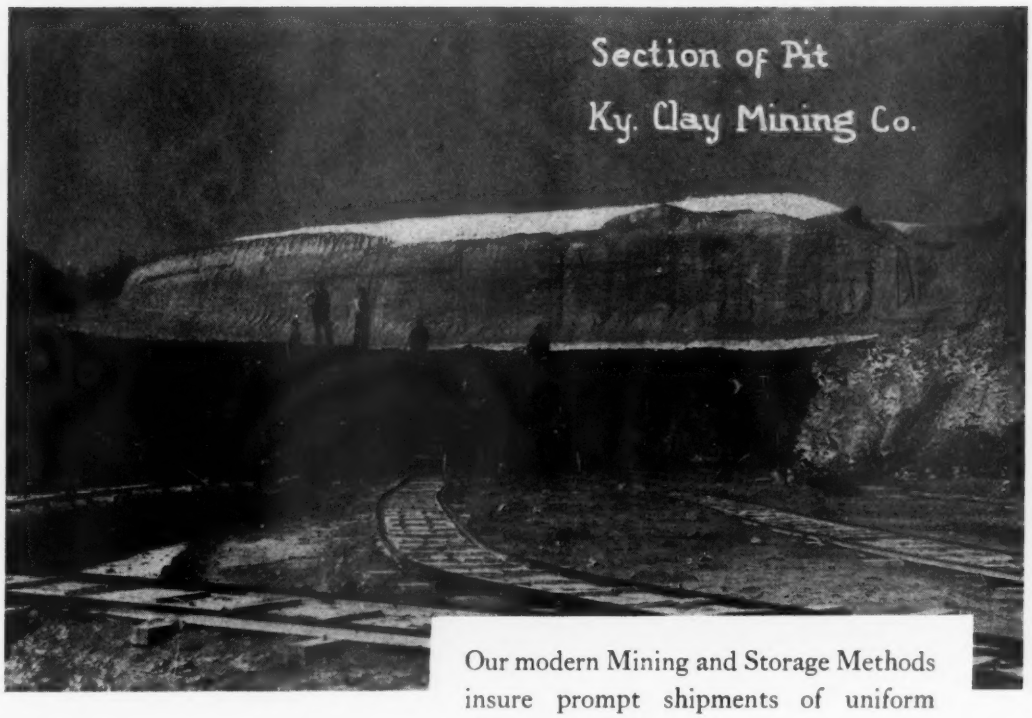

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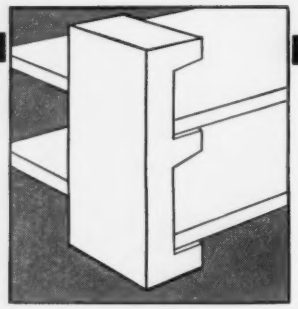

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Carborundum Co.
Norton Co.

Hose (Air and Fluid)
The DeVilbiss Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Iron Chromite
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Kilns, China (Decorating)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Swindell-Dressler Corp.

Kilns- (Electric, Circular, Tunnel)
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.

Kyanite
Celo Mines, Inc.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Electro Refractories & Alloys Corp.
Corhart Refractories Co.
Denver Fire Clay Co.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co.
Edgar Plastic Kaolin Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Loaders (Bucket)
National Engineering Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel and Mfg. Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
The Hommel Co., O., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Edgar Plastic Kaolin Co.
Foote Mineral Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Masks (Breathing)
The DeVilbiss Co.
Drakenfeld, B. F., & Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Micronized Products
Porcelain Enamel and Mfg. Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
Spencer Lens Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Mixers
Industrial Ceramic Products, Inc.
National Engineering Co.
Ransome Concrete Machinery Co.

Mixers (Batch)
Lancaster Iron Works, Inc.
National Engineering Co.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.
Ransome Concrete Machinery Co.

Mixers (Laboratory)
Lancaster Iron Works, Inc.
National Engineering Co.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.

Mullers (Batch)
Lancaster Iron Works, Inc.
National Engineering Co.

Muriatic Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.

Oxides
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
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Porcelain Enamel and Mfg. Co.
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Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Pins
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Ingram-Richardson Mfg. Co. of Indiana, Inc.
Louthan Mfg. Co.
Potters Supply Co.

Pins (Tile Setter)
Louthan Mfg. Co.

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Ransome Concrete Machinery Co.

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Great Lakes Foundry Sand Co.
United Clay Mines Co.

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Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

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Hardinge Company, Inc.
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Ingram-Richardson Mfg. Co. of Indiana, Inc.
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Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Potters Wheels
Denver Fire Clay Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Solvay Sales Corp.
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Kux-Lohner Machine Company

Producer Glass Plants
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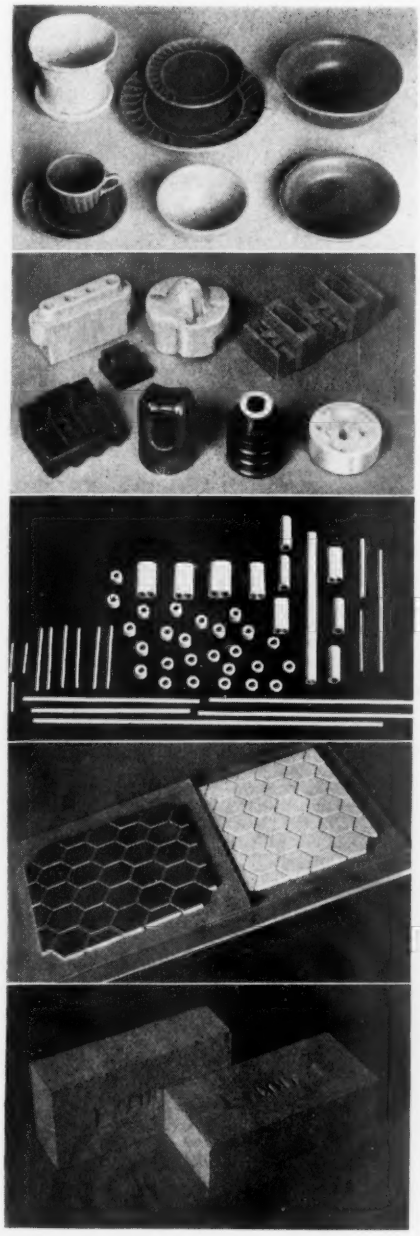
SEE "CONTROLLED MIXING" DEMONSTRATED



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Plan to discuss your special problems of body preparation, the application and advantages of the SIMPSON INTENSIVE MIXER and its auxiliary elements; its broad application to many different types of ceramic bodies; laboratory tests and determinations; results obtained in production installations; economies and improvements realized; all phases of "Controlled Mixing" by mulling in the Simpson Mixer that have made this method so successful, and significant throughout the ceramic industry.

RIGHT:

No. 2—6 ft. dia. pan Simpson Mixer, showing mulling action with heavy, wide-faced mullers—capacity up to 1000 lbs. per batch with 15–20 H. P. motor, depending on the type of body.

LEFT:

Photographs of representative pottery, electric porcelain, insulators, tile and dry press refractory brick, made from bodies prepared by mulling in the Simpson Mixers. Clays and moisture are accurately proportioned so that the make-up of each succeeding batch is identical, with a resultant high degree of uniformity of the body for forming and of the finished ware.

REDUCE MANUFACTURING COSTS, IMPROVE PLANT CONDITIONS AND YOUR PRODUCT BY INSTALLING SIMPSON MIXER UNITS—COMPLETE DATA ON REQUEST.

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Lancaster Iron Works, Inc.

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Montgomery Porcelain Products Co.

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Denver Fire Clay Co.
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Electro Refractories & Alloys Corp.
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Rutile
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Foote Mineral Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal and Thermit Corp.
Titanium Alloy & Mfg Co.
The Vitro Mfg. Co.

Saggers
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Electro Refractories & Alloys Corp.
Norton Co.
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Taylor, Charles, Sons Co.

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American Potash & Chemical Co
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
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The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
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Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Setters (Tableware)
Louthan Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.
Bethlehem Steel Co.

Silica (Fused)
Edgar Plastic Kaolin Co.
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
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Soda Ash
American Potash and Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
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Solvay Sales Corp.
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Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
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Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Silica Fluoride
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
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Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Abingdon Sanitary Mfg. Company
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Spray Booths
The DeVilbiss Co.
The Hommel Co., O., Inc.

Spraying Equipment
The DeVilbiss Co.
The Hommel Co., O., Inc.

Spurs
Louthan Mfg. Co.
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Stilts
The Hommel Co., O., Inc.
Louthan Mfg. Co.
Potters Supply Co.

Sulfuric Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Tablet Presses
Kux-Lohner Machine Company

Talc
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
International Pulp Co.
Paper Makers Importing Co.

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
The Hommel Co., O., Inc.

Tanks for Raw Material Steel or Concrete
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile Setter Pins
Louthan Mfg. Co.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.

Tile (Wall)
Denver Fire Clay Co.
Green, A. P., Fire Brick Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
American Lava Corporation
Carborundum Co.
Green, A. P., Fire Brick Co.
Louthan Mfg. Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Zircon
Edgar Plastic Kaolin Co.
Foote Mineral Co.
The Hommel Co., O., Inc.

Zirconia
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
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Zirkite (Natural ZrO_2)
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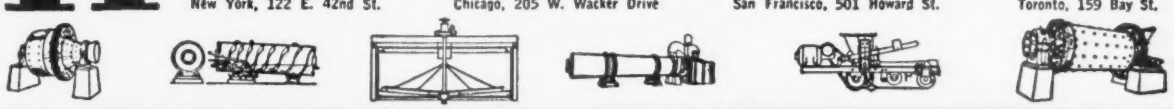

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Antimony, Black Needle
Barium Carbonate
Barium Chromate
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Cadmium Carbonate
Cadmium Oxide
Cadmium Sulphide
Calcspar
Chrome Oxide, Green
Clay, Vallendar
Cobalt Oxide, Black
Cobalt Sulphate
Copper Oxides
Iron Chromate
Iron Oxides
Kryolith
Lead Chromate
Magnesium Carbonate
Manganese Dioxide
Nickel Oxide, Black
Nickel Oxide, Gray
Nickel Sulphate
Potassium Bichromate
Potassium Nitrate
Potassium Permanganate
Powder Blue
Rutile, Powdered
Selenium
Sodium Aluminate
Sodium Antimonate
Sodium Bichromate
Sodium Silicate
Sodium Silico Fluoride
Sodium Uranate
Tin Oxide
Titanium Oxide
Uranium Oxide, Orange
Uranium Oxide, Yellow
Zirconium Oxide

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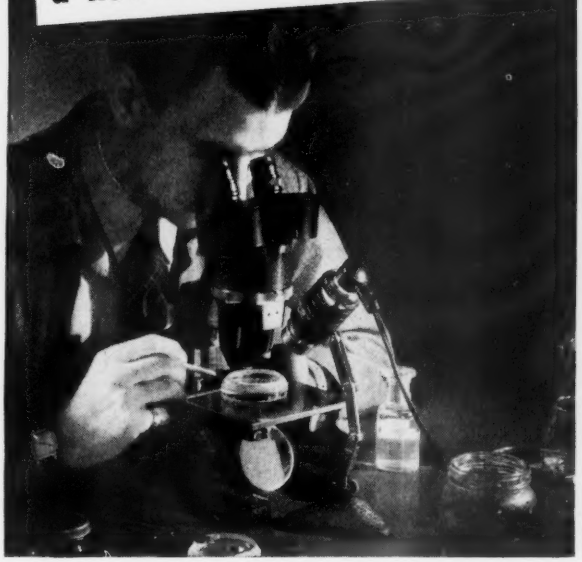
Spencer *announces* a new Stereoscopic Microscope



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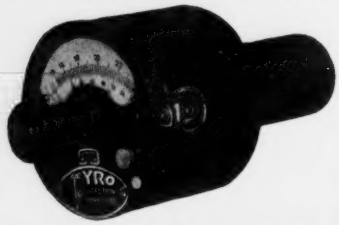

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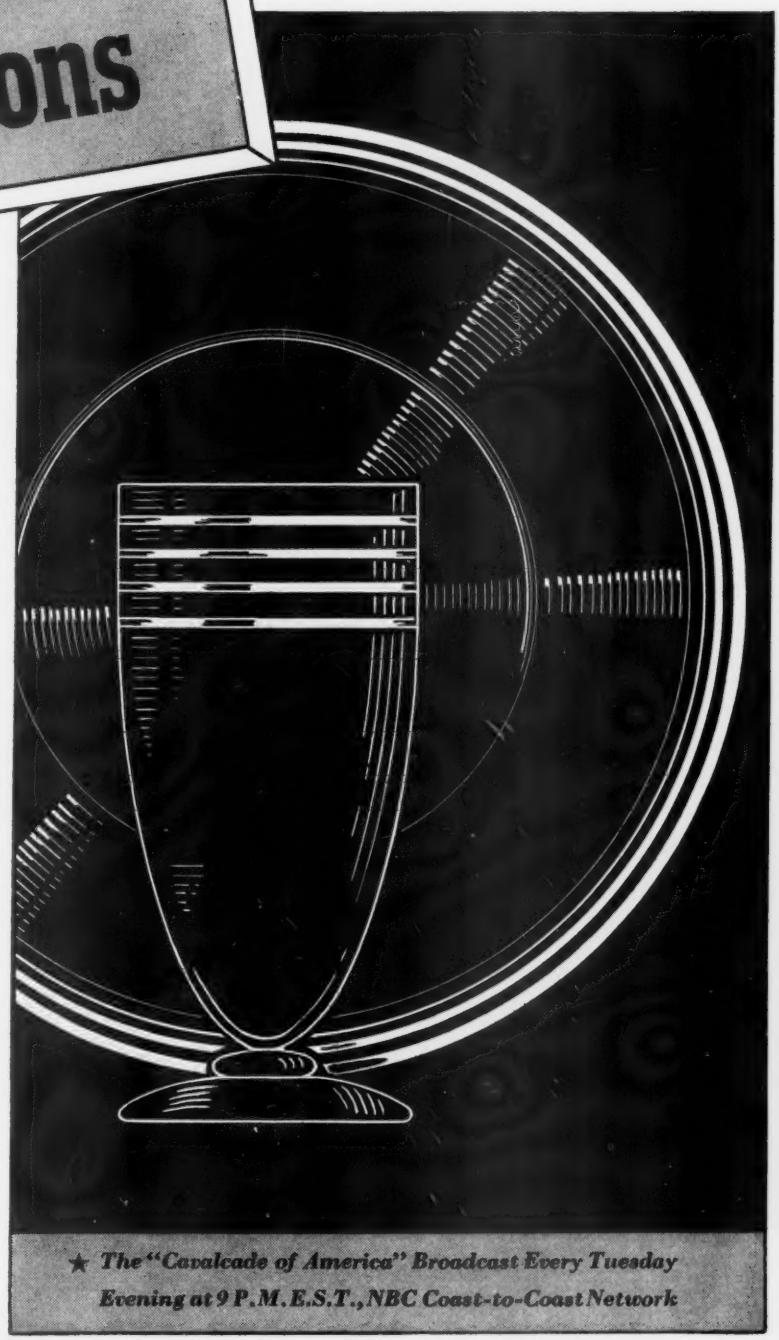

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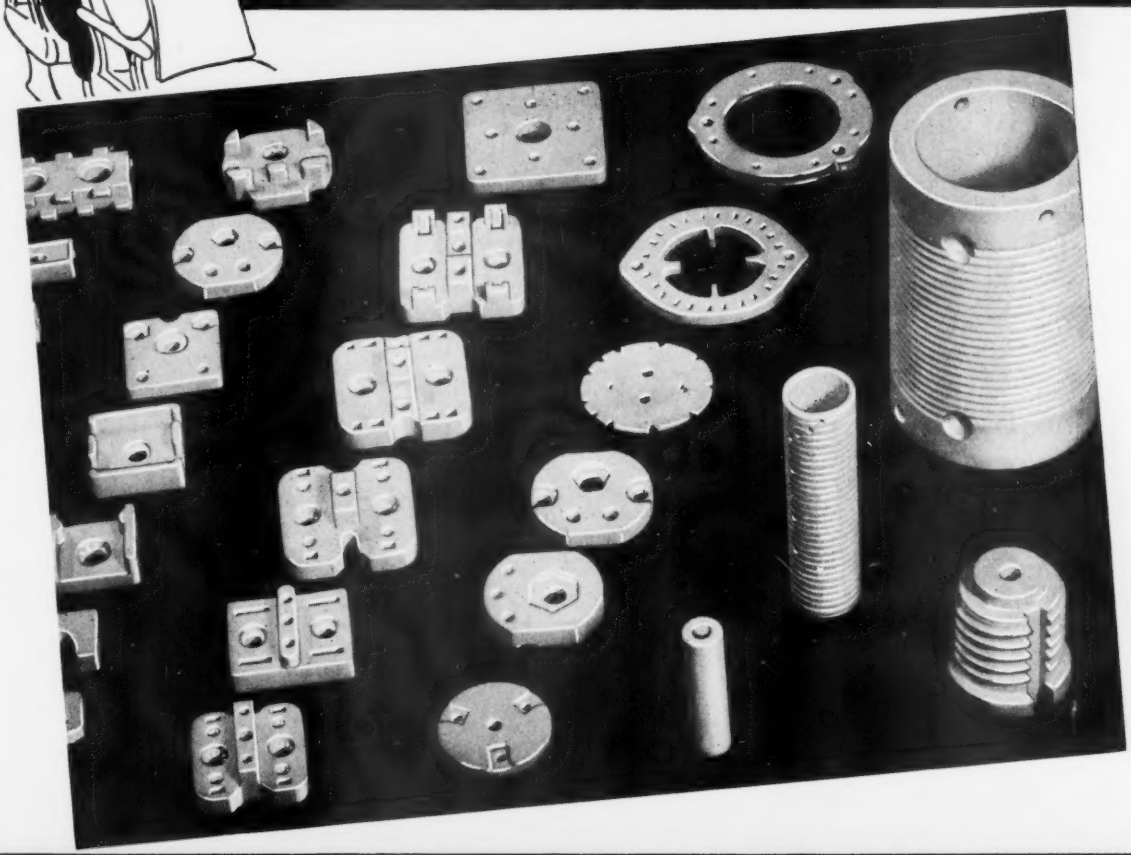

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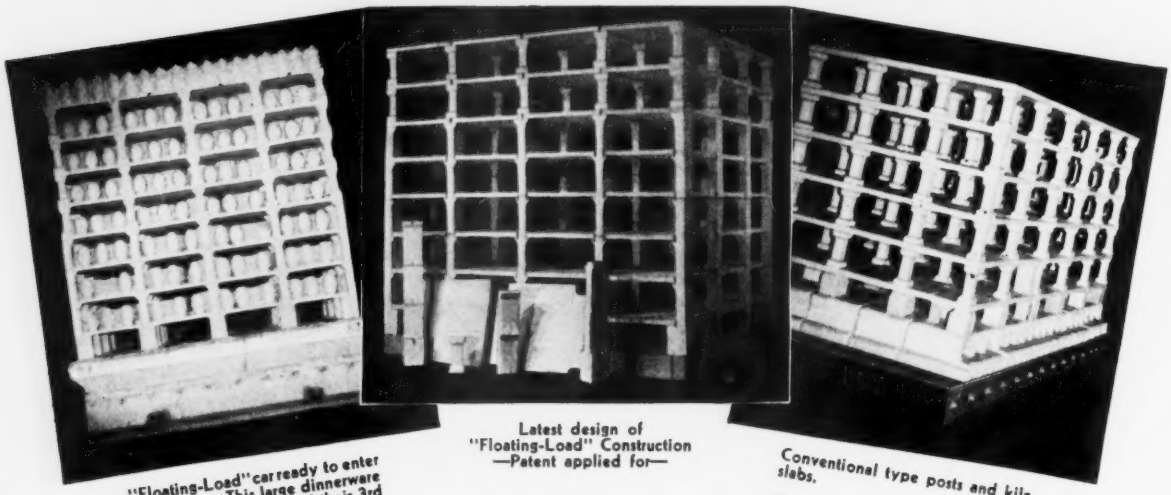

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